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NEWS AND VIEWS

Readers will find on page 56 a short note written by **Mr. L. T. Ford** just before his untimely death in January this year. **L. T. Ford** was known by repute to all Microlepidopterists, and those who enjoyed the pleasure of his personal acquaintance will appreciate how typical is this note of his modest way of understating his remarkable skill and aptitude at field-work.

It is certain that his name will in the future be linked with other notable lepidopterists, such as Stainton and Bankes, who formed their collections by rearing rather than by random collecting of moths.

An obituary of **L. T. Ford** appears in the March issue of the *Entomologist's Record,* written by his friend, Mr. S. N. A. Jacobs, and we would like to associate ourselves with this tribute.

We hope to be able to produce a paper shortly on *Acleris literana* L., which will include some new forms of this species from the **L. T. Ford** collection. His son, Mr. R. L. E. Ford, has generously offered to finance coloured illustrations for this in memory of his father.

THE LARVA OF *HYPONOMEUTA IRRORELLA* HÜBNER (LEP., HYPONOMEUTIDAE)

In May, 1959, Mr. S. Wakely and I collected some larvae which were feeding on Spindle (*Euonymus europaeus*) in a locality where *Hyponomeuta irrorella* Hübn. was known to occur. Our captures produced imagines of both *irrorella* and *H. cognatella* Hübn., but neither of us was able to distinguish between the larvae of the two species. I accordingly determined to breed *irrorella* from the egg, and put a pair of moths into a glass cylinder, enclosing a growing stem of Spindle. Ova were deposited on the stem in small clusters, a few on leaves, each cluster being covered with a secretion which hardened into membrane. The ova hatched in the late summer, but the larvae, as do those of other species in the genus, remained under the membrane until the spring, when they commenced to feed on the young growth of leaves in a common web. The larvae were full-fed in early June. In the wild state the larvae scatter in the last instar to feed singly and pupate, usually singly under a leaf on the lower part of the food-plant or on near-by herbage, including herbage on the ground. The pupa is in a loosely woven silk cocoon and is clearly visible, the yellow markings being very conspicuous.

The larva of *cognatella* is too well known to need a description here; the larva of *irrorella* is very like it and the only differences I could detect were: (i) the slightly darker colour than the greyer forms of *cognatella,* and (ii) the black spots and markings on the second thoracic plate are larger than those of *cognatella.*

LEONARD T. FORD.

FURTHER NOTES ON *HYPONOMEUTA IRRORELLA* HÜBNER

On 25th June, 1960, I happened to be in the vicinity of the locality in Kent where *Hyponomeuta irrorella* had been taken the previous year by Mr. L. T. Ford and myself. Having my bicycle with me, I paid a short visit to the particular bush of spindle which had provided us with so many pupae the previous season. Once again they were quite common, but the difference between the two seasons was very marked. Whereas in 1959 there were few parasites present, in 1960 over 50 per cent of the pupae were parasitized. Another difference was that although the 1959 pupae were invariably spun up singly, in 1960 I found several lots of two or three spun up together, and in some instances both *Hyponomeuta cognatella* Hübn. and *irrorella* were spun up side by side, sometimes as many as four mixed pupae on a leaf.

The presence of pupae under a leaf could usually be detected by the leaf being slightly curved downwards at the edges, or by the uneven appearance of a leaf making it appear different from the normal flat surface of leaves not used. Leaves of bramble, maple, hawthorn

—in fact any leaves present below the particular spindle bush—were used by the larvae to pupate under.

The marked increase in parasites is bound to have a serious effect on the species, and with less larvae and more parasites this next season the species will probably become uncommon for a few years.

26 *Finsen Road,* S. WAKELY.
London, S.E.5.

THIRD TIME LUCKY!

Do not despair, we do get those exceptional nights at times. Such was the case on 7th October last year with generator and mercury vapour lamps on the coast in Dorset.

I had previously spent the 25th to 30th September there in appalling weather conditions (no doubt most will remember the rain and gales of 1960), and made yet another attempt the following week with nothing but soaking wet sheets and an empty petrol can trying to lure in *Lithophane leautieri* Boisd., *Dasypolia templi* Thunb., and some of our more interesting migrants.

The morning of 7th October looked very promising; rain had stopped, cloudy sky, mild, and no wind (a blessing after the last few weeks). By noon I had decided on the trip and was frantically bundling all necessary gear into the car, hoping for a quick get-away. It was needed too. Flooding caused me to make a detour before arriving at 4.45 p.m., the light already quite dim; but the generator was going and sheets out by 5.30 p.m. high up on the cliff edge.

Plusia gamma L. were first in dozens, then fair numbers of *Leacania l-album* L., *A. nigra* Haw., *E. lichenea* Hübn. About 6.45 p.m., rather earlier than I had expected, one *leautieri* came in and three *Margaronia unionalis* Hübn.

A few *Leucochlaena hispida* Gey. came in, then at 11 p.m. one *Aporophyla australis* Boisd., two *Leucania unipuncta* Haw., one more *leautieri*, and more *unionalis*. I might add that by this time the light was swarming with *gamma*, no doubt a migrant cloud on the move, so I thought it time to change over to my large trap.

It was then 1 a.m., the wind freshening slightly from the south, the moon breaking through cloud, with a slight drizzle of rain on the increase. This called me to the blankets, and at dawn, 6.15 a.m., an almost gale force wind made it very difficult to inspect the trap, but three *templi*, one *unionalis* (making a total of ten), one *australis*, and one *Herse convulvuli* L. were inside, with thousands of *gamma*.

As the weather then steadily deteriorated, until it reached our usual 1960 menu, all gear was thrown into the car and off I went.

One point of interest is that the nearest *Cupressus macrocarpa* trees to the light were at least 1,000 yards away, suggesting that *leautieri* may have an alternative food-plant.

G. F. DOLLIMORE.

'Willerby', Ashley Drive Estate,
St. Ives, Hants.

SOME FURTHER CONSIDERATIONS OF TIMES AND SEASON OF THE PURPLE EMPEROR

By I. R. P. HESLOP

This paper serves both as a sequel to my 'Times of Flight' (1957, *Ent. Gaz.*, **8**: 226), in so far as the 'modifying factors' are concerned; and also as a gleaning of a wider field of topics on our species, for example, in so far as the season of appearance is concerned.

X. Modifying Factors

Pioneer Flight

It is of little use watching at a well-known focal point, such as a tree normally used either for display, assembly, etc., or for feeding, for the first specimens of the brood. These first specimens (presumably all males) invariably fly high, perhaps at from 80 to 200 feet, for the first few days; and the gaze must ever be directed upwards in order to catch sight of them. During the whole flight season, the height of flight indicated for these pioneers is exceeded only in combat. As it is, if one is standing near some familiar alighting point when these first specimens fly, one may see them pass straight over, without any circling or other sign of interest. The only exception appears to be when a specimen has actually emerged in the immediate vicinity of the 'Master Oak', in which case it is likely to pay it a momentary visit before going about its lawful occasions: it is then very wary and shy. No such visit is paid by a pioneering specimen to any tree for sustenance, since such do not appear to feel the needs of hunger for some days. Freshly emerged specimens at any time after the first few days, however, behave normally.

Display, etc.

When the pioneers do come down to lower planes, e.g. to a Master Oak, they are usually still quite perfect. They are then joined directly by freshly emerged specimens. It is necessary to understand that such a tree (nearly always an oak) is ecologically essential to the existence of a community. It must still be there even if the entomologist fails to locate it. It is necessary, too, to differentiate the Master Oak from the type of tree dealt with in the succeeding section.

The withdrawal from Monkswood, in Huntingdonshire, immediately after the First World War appears to have been due not so much to the general felling (which still left some sizable trees, and also other conditions unchanged in some parts) as to the destruction of the actual Master Oak some time later, in 1921. There is here rather an interesting, if poignant, instance of what may well be termed 'race memory'. Both in Monkswood and in a much more recent case in Wiltshire, for some years after the destruction of the respective Master Oak, specimens could be seen coming to look for it, and after wandering fitfully about for a while, going away again. Both situations were on low, or at least level, ground: I mention this to obviate confusion with the fact that where there is a well-defined

knoll of higher ground in a wood, the females will frequently await the males there.

In the Huntingdonshire case, no effective substitute appears to have been found: though the species still exists in neighbouring woods. In the Wiltshire case, after some years of uncertainty it became apparent that the species was going to hold its own. Prolonged and detailed search failed to reveal the new Master Oak; until a chance observation indicated the probability that the new focal point was not an oak at all, but an old willow. Investigations are still proceeding.

A similar function has been recorded for a Beech, and apparently for a Rowan. In Sussex the Willow has been observed to furnish an attraction parallel to other ones: in several cases in my knowledge not only was a large single Willow within a wood found attractive to both sexes, but the same consideration applied to clumps or lines of willows (but not just a single willow) standing well outside the wood.

Several Master Oaks I have known were in association with a Yew. Such a Yew is still standing in the Wiltshire wood referred to, but seems to have no attraction of its own. Occasionally two oaks together will serve the purpose of a single Master Oak: in such case, also, neither can survive the other in the exercise of this function.

Feeding Trees

As indicated, the consideration of a Feeding Tree must be kept quite distinct from that of a Master Oak. A Master Oak *may* occasionally furnish a meal: but a Feeding Tree (which is as often an ash as an oak) furnishes nothing else. A Feeding Tree can be considered as a 'modifying factor' only on the *lux a non lucendo* principle, since actually such has *no* influence on times or habit of flight. A Feeding Tree will attract the insects only when they are flying anyway. A striking distinction between a Feeding Tree and the Master Oak is that the former is *never* used for rest.

Be it noted that anyone who finds a tree of either category should keep the fact strictly to himself.

Feeding trees are not common; but one may serve a very useful purpose to the serious research worker, apart from the collector, attracting as it does both sexes and thus indicating a cross-section of the state of the species at any given moment, since the attraction is the same for both sexes. The phases of a flight may thus be accurately plotted. Again, in the latter part of the season, when the males are getting scarcer and the females may be outnumbering them, it is gratifying and instructive to notice an occasional perfectly fresh specimen, *of either sex*, put in an appearance.

See also below, under *Qualities of Attraction.*

Rain

Despite its predilection for a showery day, the Purple Emperor will not fly when *really heavy* rain is imminent. Several times I have been warned of the approach of such a downpour through a specimen,

of either sex, which had been flying normally, suddenly seeking the shelter of the interior of a heavy crown. Neither sex will fly under thundery conditions, at least during the day time. In the tropics I have found a thunder-shower at dead of night to put the Charaxes on the move.

Wind

In Wilts at least the Purple Emperor evinced in 1959 a marked dislike for a northerly wind: never flying, even under conditions of favourable temperature, when the wind was from anywhere between north-west and due east. An east wind, however, provided it was from even a little to the south of east, did not appear in itself to be unfavourable. In one wood, numbers observable were actually highest when the wind was from the south-east.

Night Flying

See obiter dictum under *Rain*.

Carrion, etc.

I did not include this in my previous paper under 'modifying factors', since I feel it to be virtually a thing of the past—see my 'Attacked by Birds' paper (1955, *Ent. Gaz.*, **6**: 175): despite his otherwise Mephistophelean habit and address, our species seemed at least no longer to be identifiable with the mephitic in odour. However, this factor was a very potent and pervading influence in the past, and there is some indication that we may have to take notice of it again.

In some localities high or offensive matter has never been attractive. For example, the old books never tell us about the species in Wiltshire, simply because bait was never attractive there. I have even gone so far as to attempt a classification of localities, and hence possibly of local races, into 'sweet' and 'sour' on this basis! Even in the 'sour' localities the habit has fallen into desuetude; though it appears to have lingered longer in Northants, and especially in Kent, than elsewhere.

However, numerous recent instances—by no means only in dry years—raise the conjecture as to whether a reversion may be occurring here and there to a habit of the really old days: as for example the instance in Sussex of eleven males being taken in one pigsty during the course of a season.

Y. Other Topics

Qualities of Attraction

It seems to me that there is a real field open for investigation into the nature of the attractions offered by 'Feeding Trees'. From observation it appears that the attraction of a Feeding Tree is of two kinds (which may occasionally be combined in the one tree), viz.:

(*a*) Where the *foliage* is imbued with honey-dew. This is dependent upon the life-cycle of the Aphis.

(*b*) Where there is a diseased condition of the *trunk* or *limb*, causing oozing, which is often accompanied by a fungus infection.

This kind is the more constant and reliable.

It should be noted that (*a*) is not attractive in all *iris* woods (compare my remarks above on 'sweet' and 'sour' localities). I have seen a honey-dew tree in one locality heavily frequented by Red Admirals and also (at that time) one or two large Tortoiseshells, but quite ignored by the Purple Emperors of which there were plenty in the wood. Whereas on a similar tree in another county, without any bark exudations as far as I could see, there were up to five Purple Emperors present simultaneously on the foliage.

Certain private researches in the chemistry of forestry, with which I happen to be acquainted, may give a clue as to the nature of the attraction in category (*b*). It had been noticed that oak transplants were devastated by the deer more than were oaks growing where they had been sown. Research showed that the transplanting produced conditions calling for increased sugar output; and it was the sugar content which probably was attractive to the deer. It seems reasonable then to suppose that the attraction of certain ailing oaks for the Purple Emperor is due to the increased sugar content of the tree which has been produced to combat the source of affliction.

The field offered for research is wide, untouched, and fascinating in potentiality.

Length of Imaginal Season

I have for some time been pondering the considerations governing this, but find myself as yet unable to formulate any hypothesis. The 1956 season, for example, was an unusually protracted one, extending into four calendar months (over ten weeks). This was a year of cool, damp weather. By contrast, the season of 1949 (a hot dry summer) burned itself out everywhere in fourteen days. The obvious factor, then, is the weather: but there must be others. And the problem becomes the more striking when one remembers that there is considerable variation between local races in respect of length of imaginal life.

Prior to 1956 I had been fostering a theory that there is a calculable limit to the individual span of life, from the moment of deposition as an egg to the moment of death as an imago. For example, if weather conditions delay the emergence of the imago until the last days of July (as has happened), does the imaginal life still go on for its customary four or five weeks (according to locality); or is there some compensatory curtailment thereof? In 1941, the first observation in Wilts was on 27th July and the last on 15th August—which latter date is not appreciably in extension of the normal for last appearance —so indicating a much curtailed flight season. In Surrey in the same year the first observation was on 30th July and the last on 24th August: showing an imaginal season still rather less than normal in length. These dates relate of course to the whole flight season, but clearly they must have some significance for individual life-span.

I still believe that my hypothesis at least gives a line of investigation: but clearly, in view of the events of 1956, the situation is much

more complex than I had at first supposed. On the other hand it is only fair to draw attention to my own note on the Garden Tiger moth (1955, *Entomologist*, **88**: 113), which seems to indicate that the *ageing process* may under certain circumstances be suspended.

Incidentally, whereas postponement of imaginal season may possibly result in curtailment, it is quite patent that early commencement will have the same result if the conditions that brought it about continue. The moral seems to be that an imaginal season starting at the *normal* date is likely to be the longest.

Double-broodedness

Is it inapposite to observe that the unusually short imaginal seasons of 1949 and 1959 were both followed by a tendency towards a second brood? In the former year there were observations in the field as well as in the cages: in the latter year, so far as I know (and I kept constant watch up to and into November) in the cages only. Perhaps the summer was a little too dry in the latter case.

Only a narrow threshold appears now to confront a second brood in the Purple Emperor. Thus, if there were any ever-green plant which the larva could be experimentally induced to eat, I believe that the stock would go through to a second brood in the majority of cases—with an adjustment of the season of the earlier brood. Weather seems to be a secondary factor here, provided there is no heavy frost. In the autumn of 1959 I took a young larva in one of my cages off its yellowing leaf, and put it on a sprig of a new plant which had been cut back in mid-June. The leaves were green and fresh, but not tender (which condition would have been fatal to the larva at this stage). Immediately the larva, which had already spun up its old leaf, began to feed again: and so continued until the first week of January, under natural conditions of temperature, when it span up finally (and then only because frost had touched its plant).

I have called attention in two papers previously (1960, *Ent. Rec.*, **72**: 25; and another paper—in re virus disease—as yet unpublished as I write this) to the effect on the imaginal season of variation in food-plant. I take the opportunity of emphasizing here that any amount of subsequent warmth and sunshine will not wholly offset the effect of late coming into leaf of the sallow, in determining the commencement of the imaginal season. Thus in 1959 in Wiltshire, despite the hot fine weather throughout the summer, the imaginal season was late in starting: wholly because the leafing of the sallow had been nearly a month behindhand. What the reason was for the tardiness of the sallow is not quite apparent.

Mass Movements, etc.

In addition to actual movements described at various times, it may be mentioned that in 1956, under conditions when the Purple Emperor was common, there were certain features which appeared at the time to indicate an impending migration. For example, there was a general overflow or spreading; and also there was laying freely in unusual sites. There was much laying on quite small bushes in this

year. It is clear now that these symptoms indicated, not an incipient expansion, but the efforts of the species to combat incipient virus disease: see my paper (1961, *Ent. Gaz.*, **12**: 42) in this connection.

I mentioned in the same paper the prevalence of females under certain conditions. Mr. Stockley has now pointed out to me that, quite apart from considerations of a diseased state, in any species an attempt to *colonize* is often betokened by a sudden flight consisting entirely, or nearly so, of females. This has been observed, for example, in the Large Pearl-bordered Fritillary; and may also explain—it is to be hoped—the high proportion and early appearance of females in the Purple Emperor in 1959.

Assignment Times

During the last few years it has been borne in upon me that individual specimens may keep time-tables of extraordinary exactness. It was specimens of distinctive appearance which first made me appreciate this fact. One of the earliest of these was a female which, though perfect, was of remarkably light ground colour. I had much else to watch; but day after day the specimen came up from the same quarter, at the same time to within a few seconds, remained on a certain sprig for a given time, and then departed to whence it had come. This was the only visit of this specimen to this point during all the hours of daylight.

This experience led me to make timed observations of other specimens which had any distinguishing feature, e.g. size, some impairment, etc. The results were striking. In 1958, in mid-August, I watched a small male appear in obedience to such precise time-table. This was in the late afternoon; and over the course of the ten days of continuous observation the appearance became steadily earlier by about five minutes over the whole period. This fact made me refer to my notebooks, and I found there a record of a male which over the course of a week had not varied a certain movement, at about noon, by more than a few seconds in time.

These observations led me to the conclusion that such precise appointments or assignments should be considered, and recorded (if the clue is considered worth following up), in calibration with the chronological position between noon (1.0 p.m. B.S.T.) and sunset or sunrise, as the case may be. In other words, by this hypothesis an observation made at noon in one week may be expected to be repeated (if of this 'assignment' nature) at noon in the following week; whereas a movement made, say, at exactly 5.0 p.m. B.S.T. on 25th July (i.e. approximately half-way between noon and sunset) may be expected to come progressively forward to just about 4.48 two weeks later: the time of sunset coming forward 24 minutes during this period. To take a potentially less precise example (since it will refer to a group instead of to an individual), if 3.45 p.m. B.S.T. (approximately one-third of the sun's course from noon, and two-thirds to his setting) is a favourite time of display on a particular

tree on 5th July (sunset 9.18 B.S.T.), on 12th August (sunset 8.27 B.S.T.), the approximate corresponding time will be 3.30 p.m.

Appearance in Flight

No species can appear in more guises while in flight, according to the positions of the observer and of the sun in relation to the insect. When the light is subdued, the general appearance of both sexes has always seemed to me as of a very rich orange-brown. Against a brilliant light it may vary from black for a male to a greyish brown for a female.

However, the white portions of the wings are particularly strongly reflective of light, so that at certain angles of observation the insect appears to have much more white on it than is actually the case: the flash of white is often the first thing seen of the insect. But I have, *mirabile dictu*, seen a 'white' *iris*.

When flying at eye-level the male appears a uniform grey-blue. I have in this connection the most vivid recollection of a male pursued, at this height, for a quarter of a mile along a Wiltshire lane in 1955. Just as I seemed to be coming to terms, it turned and 'attacked' me! Finally it flew round over my left shoulder (compare: 1857, *Ent. Wkly. Intell.*, **2**: 148), and as I whipped round I saw it positively rocket up over the wood face.

I take the opportunity of mentioning that I once, in 1949, saw a male *iris* in a manœuvre which I have never seen before or since, to wit, that of rising and falling slowly for some feet in an exactly vertical column over some attraction: the whole movement, in tempo and otherwise, reminding me of the little globes on a varying jet of water that one used to see in shooting galleries.

Perhaps, however, the most striking of all views of a Purple Emperor is as seen from vertically below, when he is displaying on a bare twig, unscreened and unshaded. Then, provided the light is high and penetrating, and the sun is not directly in one's eyes, one can see through two transparencies, as it were; and upper and under pattern and colour are magically blended into one.

Lastly, an Emperor's pattern goes right down to the membrane, so that even if the wings are rubbed and worn the pattern itself is still vivid and unmistakable, even in flight. One result of this is that that specimen, so alluring on the wing, is in the hand so often sadly disappointing: and yet, alas, judging from 'undersides' in collections, how seldom are such released!

'Belfield,'
Burnham-on-Sea, Somerset.

CTENOPHTHALMUS CONGENER CONGENER ROTHS., AND OTHER FLEAS, RECORDED FROM ESSEX

By N. R. PHILLIPS, B.Sc., Ph.D., F.R.E.S., and P. J. UNDERWOOD

A comprehensive survey of county records for British Siphonaptera and their hosts has been made by Smit (1957*a*), with additions by George (1958). Several species absent from this survey have been included in a synopsis of Essex records recently compiled by George (*Essex Nat., in press*), but there remains a considerable number of fleas which have not hitherto been recorded from the county. Seven of these are now known to occur, and are detailed below.

The primary purpose of this paper is to establish the occurrence in Essex of *Ctenophthalmus c. congener* Roths., a flea previously known only from Hertfordshire, Sussex and Middlesex. This, and other species new to Essex, are indicated * in the text. For the sake of completeness, and in anticipation of the time when, it is to be hoped, more detailed distributions are compiled, a full list of species and their hosts, as recorded by the authors, is given. Except where stated, all specimens were collected within a two-mile radius of Clacton, Essex (Vice-county 19), between 1951 and the end of 1959; for conciseness, dates and other individual data are detailed only in the case of new records. Throughout the paper, records dealing with *Apodemus* refer to *Apodemus sylvaticus* (L.), those of *Clethrionomys* to *Clethrionomys glareolus* (Schreber) and those of *Microtus* to *Microtus agrestis* (L.).

Family PULICIDAE

Sub-family Archaeopsyllinae

1. *Archaeopsylla e. erinacei* (Bouché), 1835. Commonly found in large numbers on its true host, *Erinaceus europaeus* L.; frequently taken from the dog, *Canis familiaris* L.

2. *Ctenocephalides canis* (Curtis), 1826. Recorded only from *Canis familiaris*.

3. *Ctenocephalides f. felis* (Couché), 1835. Taken from the domestic cat, *Felis catus* L. and from *Canis familiaris*.

Sub-family Spilopsyllinae

4. *Spilopsyllus cuniculi* (Dale), 1878. Common on its host, *Oryctolagus cuniculus* (L.) until the advent of myxomatosis (ca. 1954); not taken since.

Family HYSTRICHOPSYLLIDAE

Sub-family Hystrichopsyllinae

5. *Hystrichopsylla t. talpae* (Curtis), 1826. Taken regularly ex *Sorex araneus* L.; occasionally ex *Apodemus, Clethrionomys* and *Microtus*.

6. * *Typhloceras poppei* Wagner, 1903. Initial specimens ex *Apodemus,* trapped in ditch: one ♂ ex ♀ host, 25th Sept., 1959; one ♀ ex ♂ host, 3rd Oct., 1959. One ♂ ex ♀ *Clethrionomys,*

trapped hedge, 22nd Oct., 1959. Further specimens comprise six ♂, six ♀ taken, usually singly, ex *Apodemus*, 20th Oct. to 4th Dec., 1959.

Sub-family Rhadinopsyllinae

7. *Rhadinopsylla pentacantha* (Rothschild), 1897. Taken frequently ex *Apodemus*; rarely ex *Clethrionomys*. A marked proportional increase in this species has been noted during the winter months.

Sub-family Ctenophthalminae

8. *Palaeopsylla s. soricis* (Dale), 1878. Recorded commonly ex *Sorex araneus*; once each ex *Apodemus* and *Clethrionomys*.

9. *Ctenophthalmus n. nobilis* (Rothschild), 1898. Very common, with numerous records ex *Apodemus, Clethrionomys* and *Microtus*; twice taken from *Mus musculus* L.; once each ex *Rattus norvegicus* (Berk.) and *Sorex araneus*.

10. * *Ctenophthalmus nobilis vulgaris* Smit, 1955. Mr. R. S. George has kindly supplied the following details of this new record: one ♂, one ♀ ex ♂ *Microtus*, Woodford Green (V.C. 18), 30th May, 1959, G. B. Corbet. The subspecific status of the female specimen is open to doubt, on account of females of *n. nobilis* and *n. vulgaris* being inseparable.

11. * *Ctenophthalmus c. congener* Rothschild, 1907. One ♀ ex ♀ *Microtus*, trapped hedge, 14th July, 1959; one ♂ ex ♂ *Clethrionomys*, trapped ditch, 16th Sept., 1959; one ♀ ex ♂ *Apodemus*, trapped ditch, 26th Sept., 1959; one ♀ ex ♂ *Clethrionomys*, trapped hedge, 22nd Oct., 1959; one ♂ ex ♀ *Clethrionomys*, trapped hedge, 25th Oct., 1959. This species until very recently was known only from Herts. and Sussex (Smit. 1953*a* & *b*), and the only previously recorded host was *Clethrionomys*. A new record by George (1960) has extended the range of this flea to Middlesex, and its known hosts to include *Arvicola terrestris* (L.). This, and the present records, accord with the view stated by Smit (1957*b*) that *Ct. c. congener* is probably restricted to the south-east sector of England. Regarding the hosts, it now appears likely that *Ct. c. congener* shares the same species as *Ct. nobilis*, though at present there are inadequate data regarding its relative frequency on the mammals concerned. *Clethrionomys* is the most frequent host so far recorded. The distribution of *Ct. c. congener* is apparently widespread but local.

Family Ceratophyllidae

Sub-family *Ceratophyllinae*

12. * *Malaraeus penicilliger mustelae* (Dale), 1878. One ♂ ex *Clethrionomys* (sex not noted), trapped hedge, 11th Dec., 1957; eleven ♂, four ♀ ex several *Clethrionomys*, trapped ditch, July, 1959; one ♀ ex ♀ *Microtus*, trapped hedge, 14th July, 1959; one ♀ ex ♂ *Apodemus*, trapped ditch, 24th July, 1959. This species has since been recorded frequently from *Clethrionomys*, occasionally from *Apodemus* and once more from *Microtus*. George (*in litt.*) has a

hitherto unpublished record of this species, viz. one ♀ taken from ♀ *Clethrionomys,* Epping Forest (V.C. 18), 9th May, 1959, G. B. Corbet.

13. *Nosopsyllus fasciatus* (Bosc), 1800. First recorded from *Rattus norvegicus*; taken frequently ex *Apodemus,* twice ex *Clethrionomys* and once ex *Mus musculus.*

14. *Megabothris turbidus* (Rothschild), 1909. Recorded regularly from *Apodemus* and *Clethrionomys;* once each ex *Microtus* and *Rattus norvegicus.*

15. *Megabothris walkeri* (Rothschild), 1902. Taken rarely from *Clethrionomys.*

16. *Ceratophyllus g. gallinae* (Schrank), 1803. Extremely common; taken from nests of *Delichon urbica* (L.), *Passer domesticus* (L.), *Turdus ericetorum* Torton, *T. merula* L.; once ex body of *Sturnus vulgaris* (L.).

17. * *Ceratophyllus rusticus* Wagner, 1903, Twenty-four ♂, 39 ♀ ex four nests of *Delichon urbica,* beneath eaves of building, 24th Aug., 1959.

18. * *Ceratophyllus h. hirundinis* (Curtis), 1826. One ♂ ex nest of *Delichon urbica,* beneath eaves of house, 19th June, 1959; 14 ♂, 33 ♀ ex four nests of *Delichon urbica,* beneath eaves of building, 24th Aug., 1959; one ♀ (apparently a straggler) ex nest of *Riparia riparia* (L.), in sandpit, Brightlingsea (N. Essex), 22nd Sept., 1959.

19. * *Ceratophyllus f. farreni* Rothschild, 1905. Six ♂, four ♀ ex nest of *Delichon urbica,* beneath eaves of house, 19th June, 1959; about 100 specimens (sexes not noted) ex nests of *Delichon urbica,* beneath eaves of building, 24th Aug., 1959. First appearances suggest that this species is the commonest house-martin flea in the vicinity, having been present in all of six nests examined, and in considerably greater numbers than either *C. rusticus* or *C. h. hirundinis.*

20. *Ceratophyllus s. styx* Rothschild, 1900. Taken in considerable numbers from nests of *Riparia riparia,* Brightlingsea.

The new S. Essex record for *Ctenophthalmus nobilis vulgaris* is of considerable interest on account of an apparent absence from N. Essex. The records of the senior author for 1959 show a total of 287 *Ct. n. nobilis* (129 of them males), the counterpart of *Ct. n. vulgaris* in eastern England. Moreover, four specimens of the much rarer *Ct. c. congener* were taken. Despite intensive collecting, therefore, and notwithstanding the abnormal climatic conditions of 1959, there has so far been no evidence to indicate that *Ct. n. vulgaris* occurs in this part of N. Essex. In the absence of other records, this new and isolated occurrence of the latter sub-species suggests that S. Essex lies on the extreme eastern fringe of its distribution. It should be noted that *Ct. n. vulgaris* has already been recorded from the adjoining counties of Herts. and Middlesex (Smit, 1957*a*).

It will be seen from the above list that certain species of fleas are conspicuously absent. It has not been possible to examine bat fleas, and no material has been obtained from moles nor from some birds.

The number of species and sub-species of fleas from Essex published to date is now thirty-three; with further collecting, it is hoped to obtain at least the following species which are not yet known from the county: *Rhadinopsylla isacantha* (Roths.), *Palaeopsylla m. minor* (Dale), *P. kohauti* Dampf, *Ischnopsyllus elongatus* (Curtis), *Nycteridopsylla longiceps* Roths., *Peromyscopsylla silvatica spectabilis* (Roths.), *Ceratophyllus vagabundus insularis* Roths., *C. columbae* (Gervais).

ACKNOWLEDGMENT

The authors' thanks are extended to Mr. R. S. George for his valuable suggestions and repeated goodwill during correspondence.

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OIDAEMATOPHORUS BOWESI WHALLEY (LEP., PTEROPHORIDAE) IN FRANCE

Recently I received from Dr. L. Bigot of the Station Biologique, Camargue, S. France, a male plume moth which he had identified as *Oidaematophorus bowesi* Whalley. This specimen had been collected by him at La Crôtat, B. de Rhône, S. France, in November, 1957, and had been correctly identified. This is the first positive record of this species outside Britain.

When this species was described (Whalley, 1960, *Ent. Gaz.*, **11**: 29) from southern England, there were no specimens known for certain to have come from outside Britain. There were two specimens, possibly from Draguignan in the south of France, but at the time of writing that paper there was considerable doubt as to the accuracy of the labels. The new evidence suggests that these may well be genuine French specimens.

It is interesting that this species, which in Britain is restricted to Kent and Sussex, is present in the south of France, but is not yet known from any intermediate localities.

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Department of Entomology,
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THE LARVA OF *HYDROPTILA SPARSA* CURTIS (TRICHOPTERA: HYDROPTILIDAE)

By HILMY M. HANNA, Ph.D., F.R.E.S.
Assiut University, Egypt

Seventeen larvae of this species were found by chance on some filamentous algae when I was collecting the larvae of *Göera pilosa* (F.) from Foudry Brook at Mortimer station near Reading in late July, 1954. Another visit was paid to the brook in early August and fifty-two larvae were found on the stones as well as on the filamentous algae. Many larvae were reared to the adult stage. Mr. D. E. Kimmins kindly identified the adults for me as *Hydroptila sparsa*.

The larvae collected from Foudry Brook were checked against specimens collected from the Whitewater River near the point where the Blackwater River flows into it near Swallowfield, Berkshire. The following details are derived from the study of a large number of fully-grown specimens.

Case

The cases are up to 4.5 mm. long and 1.6 mm. wide and are made of very fine sand grains. The dorsal surface of the case is convex, whereas the ventral surface is almost flat. In some of the cases the dorsal surface has a small hump in the middle. The case is sagittally compressed and is composed of two symmetrical halves. There is a slit at each end and each slit is surrounded by a semi-circular valve.

Larvae

The larva is campodeiform. The larvae are 3.6 mm. long and 0.7 mm. wide. The thorax and the abdomen are compressed laterally.

Head

The head is prognathous and has no distinct sutures. The region of the frontoclypeus is greyish-brown. There is also a greyish-brown area at the posterior margin of the head, which has lighter spots. This area extends across the sides of the genae to join the two greyish-brown bands on the ventral surfaces of the genae. The rest of the head is creamy in colour. The antennae are long and have two segments. The distal segment has a long hair on its inner surface and a sensillum at its end.

Labrum

The labrum is pale yellow in colour. The anterior margin has a large concavity, which has a hairy brush. On each side of the concavity there are four long setae. The edges of the labrum are highly sclerotized.

Mandibles

The mandibles are asymmetrical. The right mandible has three teeth and has no brush on its inner surface. The left mandible has four teeth and there is a hairy brush on its inner surface. Both mandibles have two long setae on their outer surfaces near the base.

Maxilla

The cardo is small and has a single seta. The distal margin of the stipes has two setae. The maxillary palp has five segments, of which the second segment has a few hairs. The lacinia has a few sensilla and a group of hairs.

Thorax

The pronotum is entirely sclerotized, has a median longitudinal suture and a transverse greyish-brown band on its anterior third. The posterolateral and posterior margins of the pronotum are dark brown. There is a greyish-brown band on both sides of the posterior two-thirds of the median suture. The anterior margin of the pronotum is lighter in colour than the rest of the pronotum. The mesonotum and the metanotum are sclerotized except for their margins, have median longitudinal sutures and are lighter in colour than the pronotum. Their posterior margins are dark brown and the anterolateral corners have a dark-brown spot and an oblique greyish-brown band.

Legs

The prothoracic leg is slightly shorter than the mesothoracic and metathoracic legs, which are equal in length. The femur of the prothoracic leg is noticeably flattened and has two projections on which there are two thick setae. The tibiae of all the legs have two spurs and those on the prothoracic tibia are situated on a long projection.

Abdomen

The first abdominal segment is small and has no protuberances. The fourth abdominal segment is the largest, after which the segments become smaller towards the posterior end. The lateral line, the abdominal gills and the anal sclerite are absent. The eighth tergum has six long setae and a few short scattered setae at its posterior margin, while the ninth tergum has four long setae, four medium setae and two short setae. The anal claw has two auxiliary claws at its base.

The genus *Hydroptila* is represented by eleven species on the British list of Trichoptera. The larvae of the other ten species have not been discovered yet among British material. Ulmer and Silfvenius gave brief descriptions of *H. femoralis* (Eat.), *H. maclachlani* Klap., *H. pulchricornis* (Eat.) and *H. sparsa*. Nielsen (1948) gave a detailed description of the larva of *H. femoralis*.

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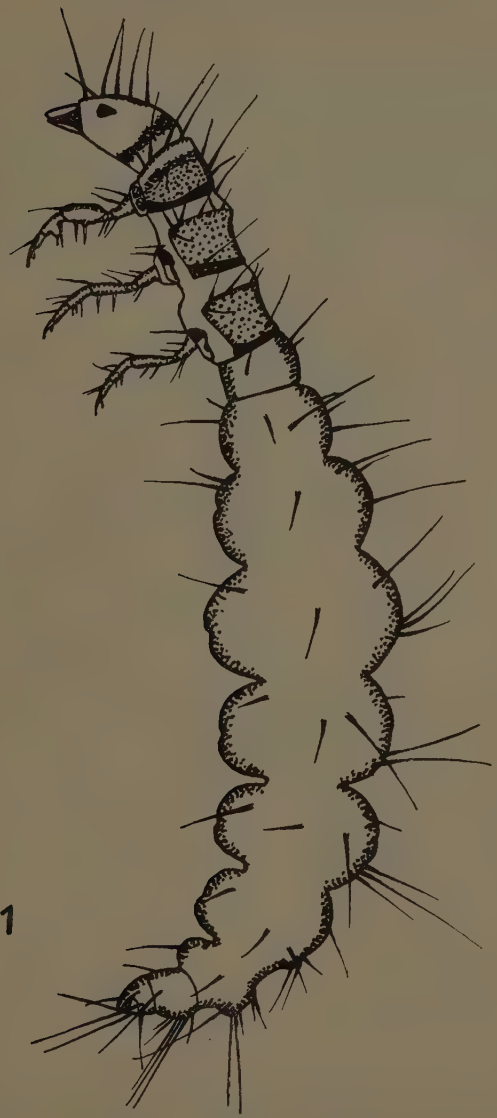
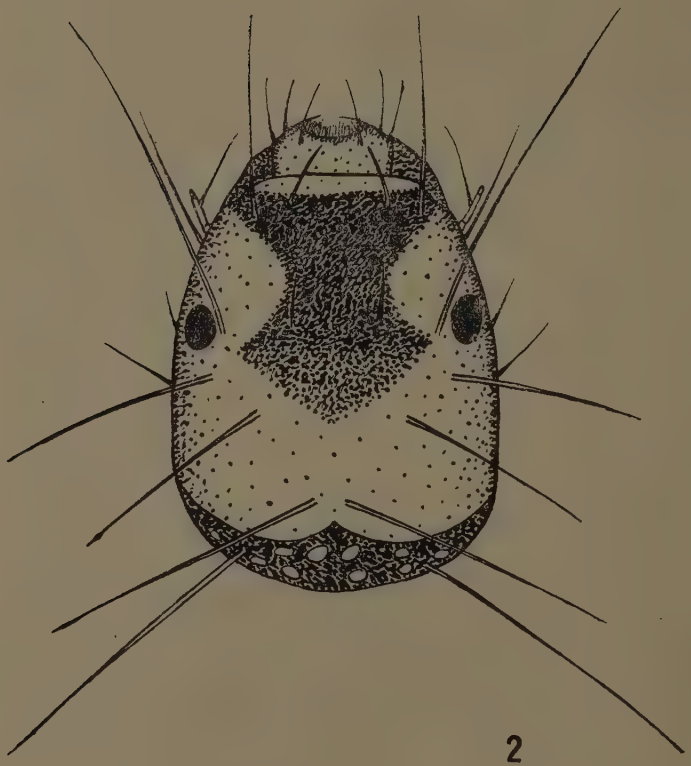
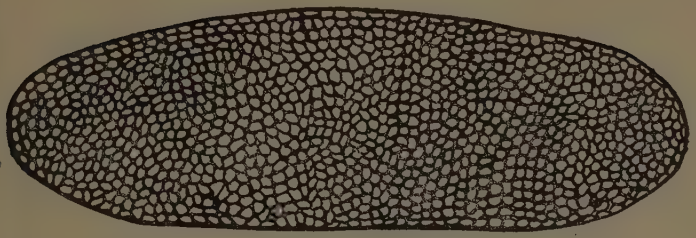


Larva of *Hydroptila sparsa* Curtis Fig. 1: Larva (side view).



Larva of *Hydroptila sparsa* Curtis

Fig. 2: Head (dorsal view).



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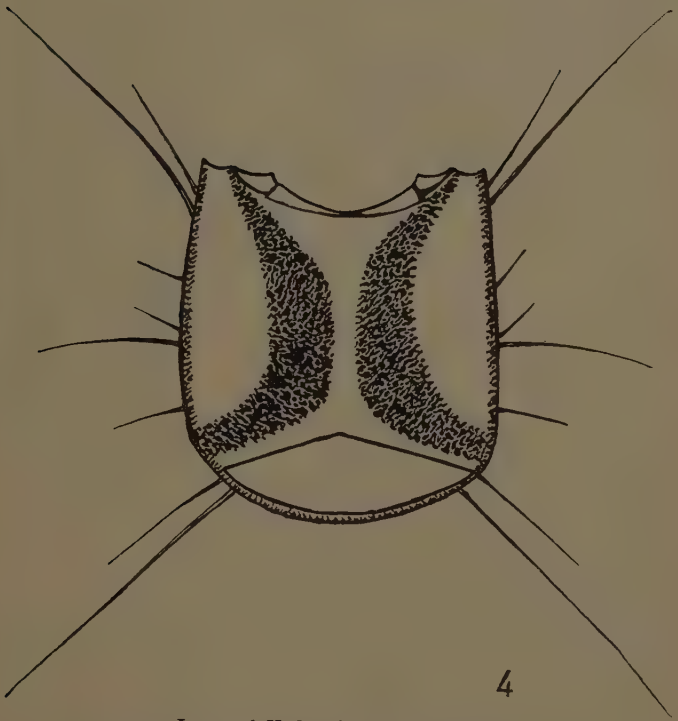

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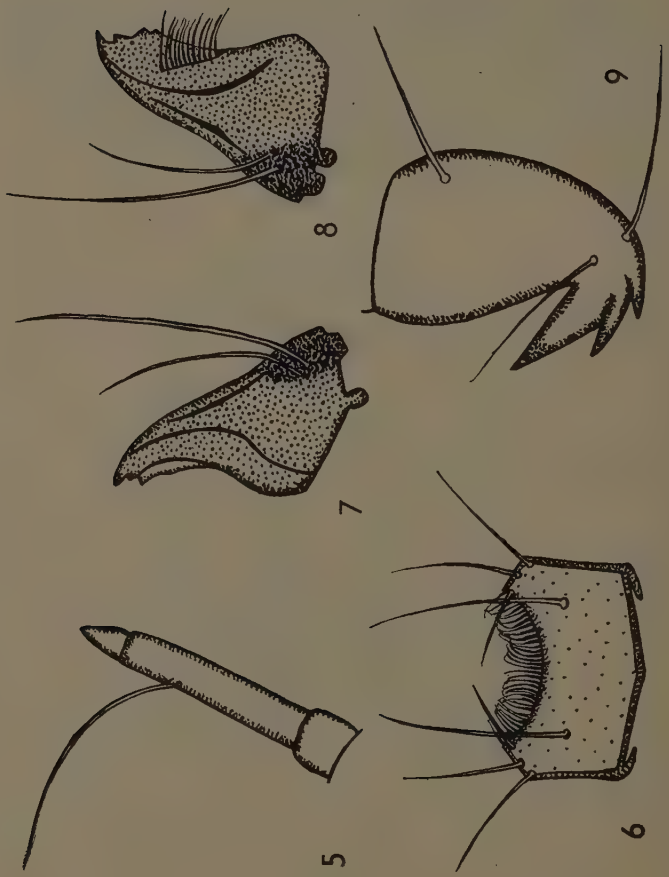
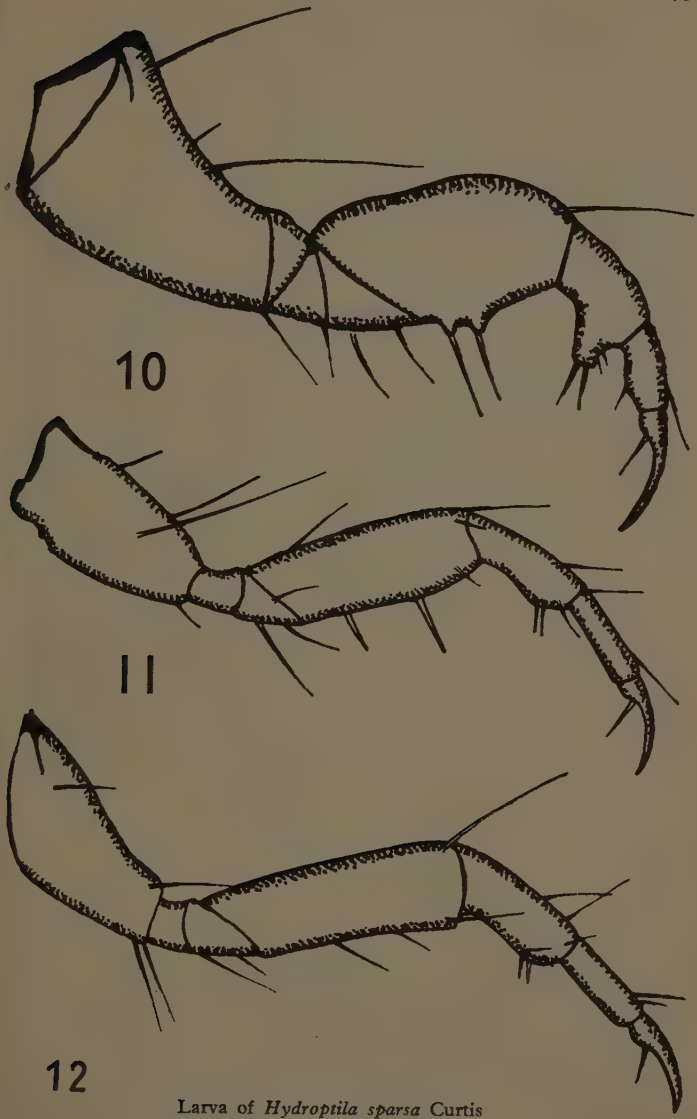
Larva of *Hydroptila sparsa* Curtis

Figs. 3-4: (3) Larval case. (4) Head (ventral view).



Larva of *Hydroptila sparsa* Curtis

Figs. 5-9: (5) Antenna. (6) Labrum. (7) Right mandible. (8) Left mandible. (9) Anal claw.



Larva of *Hydroptila sparsa* Curtis

Figs. 10-12: (10) Prothoracic leg. (11) Mesothoracic leg. (12) Metathoracic leg.

CHRYSOCRAMBUS CORNUTELLUS PIERCE, 1938, A SYNONYM OF *C. SARDINIELLUS* TURATI, 1911 (LEP., CRAMBINAE)

By PAUL E. S. WHALLEY

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In a recent paper (1959, *Entomologist,* **92**: 183), I discussed the identity and British status of *Chrysocrambus cornutellus* Pierce. At the time of writing that paper, the female of a related species of *Chrysocrambus, C. sardiniellus* Turati, was unknown and I speculated on the relationship of these two species.

Through the kindness of Col. C. W. Mackworth-Praed I have been able to examine a small series of *C. sardiniellus* Turati collected by him in Sardinia in 1960. This series included a female, the first known of this species.

Examination of the genitalia of this specimen has proved it to be identical with *C. cornutellus* Pierce. The illustration of the bursa of the female of *cornutellus* Pierce in my paper (*op. cit,* p. 180, fig 4b) can be taken as representing the bursa of *C. sardiniellus* Turati. Col. Mackworth-Praed has kindly presented the specimens of *sardiniellus* Turati to the British Museum (Natural History). No authentic British specimens of this species are known.

The synonymy of this species is thus:

Chrysocrambus sardiniellus Turati

Crambus craterellus ssp. *sardiniellus* Turati, 1911, *Bull. Soc. ent. Fr.,* **1911**: 293.

Crambus sardiniellus Turati, Müller-Rutz, 1931, *Mitt. Schweiz. ent. Ges. Bern.,* **15**: 36.

Chrysocrambus cornutellus Pierce, 1938, *The Genitalia of the British Pyrales with Deltoids and Plumes,* p. 20. **Syn. nov.**

Crambus (*Chrysocrambus*) *sardiniellus* Turati, Bleszynski, 1957, *Acta Zool. Crac.,* Krakow, **1**: 445.

A NOTE ON THE PREY OF *NOTONECTA GLAUCA* L. (HEMIPTERA)

On 14th February, this year, while collecting water beetles in a pond near Holmwood, Surrey, I took a specimen of this bug eating a small beetle, *Helophorus aquaticus* L. The beetle was dead and the rostrum of the bug was inserted into it between the head and the anterior margin of the pronotum.

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ANTENNAL OLIGOMERY IN THE PENTATOMIDAE (HEMIPTERA-HETEROPTERA)

By I. LANSBURY

Antennal oligomery is frequently encountered in the Hemiptera, in particular the Lygaeidae (Leston, 1953). In the other families it does not seem to have been recorded very frequently, but Balazuc (1952) gives a comprehensive bibliography. Several examples of Pentatomidae have come to hand recently with malformed antennae. These are described in detail below. Why this condition does occur is not fully understood. Woodroffe in a private communication writes that in rearing *Eurydema dominulus* (Scop.) dry conditions may have been the cause of the oligomery, although only one specimen was affected. It seems fairly certain that damage or amputation of antennal segments during the immature stages must account for most of the examples which come to notice.

MATERIAL EXAMINED

Odontoscelis dorsalis (Fabr.) male, Penhale Sands, Cornwall, 10.vi.1956. G.E.W.

Right-hand side normal; left-hand side oligomerous.

	1st	2nd	3rd	4th	5th
r.h.s.	100	72	54	90	90
l.h.s.	100	109	109	81	100

On the oligomerous side there is no appreciable swelling of the fused 2nd/3rd segments. Figures represent percentage length compared with that of 1st segment on right-hand side.

Palomena prasina (L.) male, Combley Great Wood, Isle of Wight, 16.x.1954. G.E.W.

Right-hand side normal; left-hand side oligomerous, the basal and 2nd segments are normal, 3rd segment slightly shorter and thicker; 4th and 5th segments are fused together, being two-thirds as long as those segments on the normal side. The fused segments are about one quarter times greater in diameter at widest point than those of the right-hand side.

P. prasina male, Roughan Crag, Kilnaboy, Co. Clare, 22.ix.1960, taken on hazel. I.L.

Left-hand side normal; right-hand side, basal, 2nd and 3rd segments normal, 4th and 5th segments fused together, forming a segment, being just over two-thirds the length of the 4th and 5th segments on the left-hand side.

Dolycoris baccarum (L.) female, Roughan Crag, Kilnaboy, Co. Clare, 22.ix.1960, taken on blackberry. I.L.

Left-hand side normal; right-hand side, basal, 2nd, 3rd and 4th segments normal, 5th segment two-fifths the length of the normal side.

Piezodorus lituratus (Fabr.) female, Hunters Inn, North Devon, 16.vi. 1960, taken on gorse. I.L. See Fig. 1.

Left-hand side normal; right-hand side oligomerous.

	1st	2nd	3rd	4th	5th
l.h.s.	100	160	200	220	220
r.h.s.	100	140	100	260	260

The 4th and 5th segments on oligomerous side about twenty-five per cent thicker than the 4th and 5th on the normal side.

Eurydema dominulus (Scop.) male, bred vi.1959, from East Malling, Kent. G.E.W.

Left-hand side normal; right-hand side oligomerous, basal and 2nd segments normal, 3rd segment compressed to just over half normal length, 4th segment appears to be missing, 5th segment about one-twelfth shorter and slightly thicker than the normal side.

E. oleraceum (L.) male, Ash Vale, Hampshire, 25.v.1951. G.E.W.

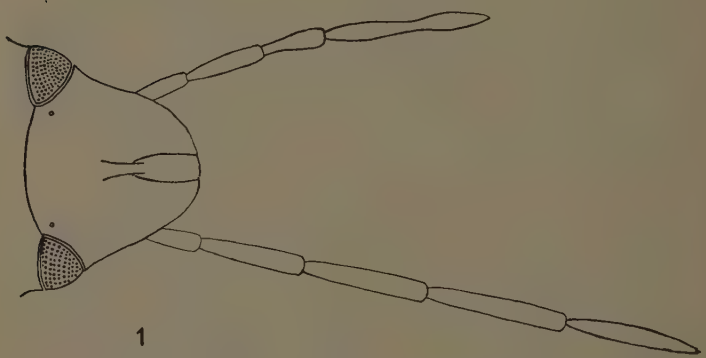

Fig. 1: *Piezodorus lituratus* (Fabr.), showing antennal oligomery.

Left-hand side normal; right-hand side oligomerous.

	1st	2nd	3rd	4th	5th
l.h.s.	100	146	130	192	215
r.h.s.	92	169	169	215	215

Figures represent percentage length compared with that of 1st segment on left-hand side.

E. oleraceum male, Jealotts Hill, Berkshire, 23.iv.1946. G.E.W.

Right-hand side normal; left-hand side oligomerous.

	1st	2nd	3rd	4th	5th
r.h.s.	100	210	170	240	280
l.h.s.	100	210	200	320	320

Figures represent percentage length compared with that of 1st segment on right-hand side.

E. oleraceum male, Goring, Oxfordshire, 22.iv.1945. B.M.H., on *Sisymbrium alliaria.*

Right-hand side normal; left-hand side oligomerous.

	1st	2nd	3rd	4th	5th
r.h.s.	100	180	150	240	270
l.h.s.	100	190		250	250

Figures represent percentage length compared with that of 1st segment on right-hand side.

The following data are of a specimen of *E. oleraceum*, male, Sandwich, Kent, 6.ix.1922, E.C.B., which is not oligomerous, for comparison with the foregoing examples.

	1st	2nd	3rd	4th	5th
r.h.s.	100	200	180	250	270
l.h.s.	100	200	180	250	270

Figures represent percentage length compared with that of 1st segment on right-hand side.

Picromerus bidens (L.) male, Chobham, Surrey, 8.viii.1956. G.E.W. Right-hand side normal; left-hand side oligomerous. Basal segments normal on both sides.

	2nd	3rd	4th	5th
r.h.s.	100	100	114	107
l.h.s.	114	135	135	95

Figures represent percentage length compared with that of 2nd segment on the right-hand side.

Abbreviations: r.h.s. (right-hand side), l.h.s. (left-hand side), G.E.W. (G. E. Woodroffe), E.C.B. (E. C. Bedwell), B.M.H. (B. M. Hobby).

I wish to acknowledge the loan of certain specimens from Mr. G. E. Woodroffe.

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OBSERVATIONS ON *ISCHNURA PUMILIO* (CHARP.) IN BRECONSHIRE, 1959 AND 1960 (COENAGRIIDAE, ODONATA)

By DAVID KYLE, M.A., M.B., B.Ch.

INTRODUCTION

After the chance discovery of a few specimens of the rare dragonfly *Ischnura pumilio* (Charp.) var. *aurantiaca* Selys in 1958, the little pool where the find was made naturally became the focus of much more concentrated attention in 1959.

On a bright sunny day at the end of April, a short search was made round the edges of the pool for nymphs, and many were found which fitted the description of *Ischnura pumilio*. A few were brought home and were left in a glass tank. In due course they hatched out into male specimens of *pumilio*, thus proving the presence of a breeding colony, and, from the number of nymphs seen, a very thriving one. These particular specimens hatched out when I was away from home for a few days and were found dead in the water on my return, so I did not observe their actual emergence or their development to maturity.

On 31st May the first specimens were seen flying at the pool, both males and females, in fair numbers. All the females were var. *aurantiaca*. On 3rd June they were present in large numbers, and still every female was var. *aurantiaca*. By 16th June there were still very many males but the females were very scarce. One or two var. *aurantiaca* were seen, and one or two normal dark-coloured females as well.

By 23rd June the colony must have numbered a few hundreds, and at least forty pairs were seen mating during a short visit. All the mating females were of the typical form, and the apple-green under-surface of the body was very conspicuous as they flew around *in copula*. Only two specimens of var. *aurantiaca* were seen and were not mating. After this day no further specimen of the variety was observed. The colony continued to flourish in July, but began to diminish at the end of the month, and faded away about the end of the first week in August.

No specimens of *Ischnura elegans* (Van de Lind.) were seen at this particular pool, which appeared to nourish a pure colony of *Ischnura pumilio*. At another small pool about a mile away a second pure colony of *pumilio* was found, much less abundant, but also breeding, and at yet another pool almost equidistant from the first was a large colony of *Ischnura elegans*, but no *Ischnura pumilio*. On 16th June one atypical male specimen was seen and caught. In this specimen all the blue of the normal male was replaced by a yellow-grey colour. It may have been a teneral colour form, though it showed otherwise no sign of immaturity, and for the purpose of my own records I have called it the fulvous variety. Only one example of it was seen.

To me the most interesting problem that arises from this study revolves round the status of the var. *aurantiaca*. The variety is very distinctive, and more easily observed than the typical form. It is found only in the female and appears in large numbers at the same time as the males. It has never been seen *in copula*, and appears to have no attraction for the males. After about two weeks it gradually disappears, with the result that for a few days there are practically no females to be seen at all. After this it is entirely replaced by equally large numbers of typical females, which obviously possess great attraction for the males.

Two theories can be advanced which would fit the observed facts. The first would assume that the var. *aurantiaca* are sterile 'asexual' females, unattractive to the males, but appearing at the same time. For no clear reason it dies off in two or three weeks, to be replaced by a new hatch of typical females, which carry on the race.

The second theory would postulate that the var. *aurantiaca* is a teneral form, in which the immaturity lasts for about two weeks. It then goes into retreat after being seen round the pool for a few days, for it is certainly not seen flying, and has not been observed in any intermediate stage. Finally, after a period of re-adjustment it emerges again as the perfect female.

Either theory can only be proved by further observation and experiment. Miss C. Longfield in *The dragonflies of the British Isles* (1949) says of var. *aurantiaca*: 'There is evidence that this is only a teneral colour form', but does not state what the evidence is. It would seem to me on the balance of probabilities that the second theory is the more likely and the less far-fetched. The final solution may be difficult to elucidate without large cages in which living specimens can be kept under reasonably natural conditions for a long period to observe beyond doubt what actually happens.

Observation and Experiment

Thus matters stood at the end of 1959. After some correspondence with Miss C. Longfield, for whose advice and enthusiastic encouragement I am deeply grateful, it became obvious that the theories depended too much on unsupported speculations, and that further observation and experiment was required to bring any clear light to bear on the affairs of *I. pumilio*. The following lines of approach came to mind:

1. Breeding of nymphs.
2. Further observation in the field.
3. Marking specimens with cellulose paint, in the hope of tracing them later in the year.
4. Dissection of the two female forms, to demonstrate the state of the ovaries.
5. Making microscopic sections for the same purpose.

1. *Breeding*

The results of this were extremely interesting and very unexpected. Eight nymphs were caught in early May, 1960, and were left in a glass tank in a small greenhouse, all the windows being sealed with net curtain. The top of the tank was also covered with net, and after the nymphs had hatched the dragonflies were taken out of the tank and allowed to fly free in the greenhouse. This arrangement was not altogether satisfactory because some of the dragonflies must have flown against the net in their initial flight and fell back into the water, where they were either drowned or damaged. All the nymphs hatched out during the first week of June, and out of the total of eight five were male and three were female.

The first to hatch was a male, and to my great astonishment it was a var. *aurantiaca*. The light colouring of the head and thorax was orange, the under-surface and the sides of the abdominal segments were orange, and part of the eighth and all of the ninth segment was orange. After about twenty-four hours the orange became yellow-grey, and here without doubt was the atypical male caught in 1959, which I had termed for my own purposes the fulvous variety. After a further twenty-four hours the yellow shade disappeared, and there in its place was the typical adult male with the dark abdomen and the blue tail.

Two other males survived for forty-eight hours or more, and the same sequence of events was seen. The two remaining males did not achieve this span of life as they fell back into the water from their twig of emergence and were drowned while still in the orange stage. Two specimens, one in the orange stage and one in the yellow-grey stage, have been preserved in surgical spirit and still show the colouration described.

Three females hatched out and each was a typical var. *aurantiaca* female. Two of them died in twenty-four hours after having fallen back into the water, but the third exceeded all expectations by surviving for seven days. It spent most of its life hanging motionless from a wooden beam in the roof of the greenhouse, though it flew about quite frequently for short periods, and then returned usually to the same resting-place. Its flight was quite strong and as the days went by the general colour became darker, though it still retained the general var. *aurantiaca* pattern. On the eighth morning it could not be found, and the most careful search of the greenhouse revealed no trace of it. It may have been eaten by a stray spider or it may have found its way out through some small chink in my defences, urged on by instinct to find its way back to water as maturity approached.

2. *Observation*

As in 1959, the earliest females seen were var. *aurantiaca* and were found mainly flying among the reeds around the pond. The males were flying at the same time, though more adventurously. As before,

they took no notice at all of the orange females. The dragonflies were not in such large numbers as in 1959, possibly because the pool became rather dried up in that year and life may have been very difficult for the nymphs. But the general pattern of behaviour was the same. At no time was a male seen mating with an orange form or even attempting to do so. The same gap was observed when practically no orange form was seen, and a week or so later the standard females appeared and mating began.

3. *Marking with paint*

Several female specimens of var. *aurantiaca* were marked on the forewing with a tiny dot of cellulose paint, in the hope that their future career could be followed throughout the season. At the time it seemed unlikely that this manœuvre would prove to be of much value as the specimens marked were all rather teneral in their wing-structure. Only one was able to fly after the paint was applied, and that only feebly. It is improbable that it survived to maturity and certainly it was never seen again.

4. *Dissection of specimens*

In view of the small size of *I. pumilio* I felt that ordinary macroscopic dissection would be very difficult and not very revealing. Through the kindness of Miss E. M. Sheppard of the Department of Zoology in the University College of South Wales and Monmouth, I was put in touch with Dr. B. W. Staddon of the same department, who volunteered to dissect some of the specimens for me under the dissecting microscope. I sent him two orange females and two dark females, and his report is as follows. I am most grateful for his assistance.

'In both normal and var. *aurantiaca* females the ovaries extend the length of the abdomen, but in the case of normal females large mature eggs are present throughout, whereas in the case of var. *aurantiaca* females no large eggs are to be found. To be associated with this the abdomen is slightly distended in the case of the normal females. A further point of interest which emerged from the dissection lies in a difference in the consistency of the cuticle—the cuticle of normal females appears to be harder and more readily split than in var. *aurantiaca* females, in which the cuticle appears soften with a tendency to fragment on cutting. In other words, one gains the impression that var. *aurantiaca* females have recently emerged and that the cuticle is still in some degree soft, whereas in normal females it has hardened fully.'

5. *Microscopic section*

This method was employed as an alternative means of examining the ovaries, and I would like to thank Dr. D. MacKinnon of Merthyr Tydfil, who cut the sections for me. The dark females sectioned well and the eggs are clearly seen. But the var. *aurantiaca* did not process well because of their immaturity, and the sections were not satisfactory.

SUMMARY

From these observations the following points emerge:

(a) All females and all males emerge with orange coloration.
(b) The males mature in about thirty-six to forty-eight hours, the 'tail' becomes first yellow-grey, then grey, then finally blue, and the body gradually darkens during the same period.
(c) The only female of whose age I could be sure had not attained its mature colouring after seven days in captivity.
(d) On frequent visits to the pool during two seasons, no orange female has yet been seen *in copula.*
(e) The orange female is not asexual but contains immature eggs.
(f) The dark female contains mature eggs.
(g) No intermediate female form has so far been seen.

There are two outstanding lacunae in the body of knowledge I have collected. I do not know what happens to the immature orange female after its first few days of life, when it is no longer seen at the pool, and I have not as yet been able to find an intermediate female form corresponding to the yellow-grey and grey form of the male.

Obviously my first theory, that var. *aurantiaca* is an asexual form, is disproved by the results of Dr. Staddon's dissection I conclude therefore, that the orange form, both male and female, represents a teneral stage and that the female matures much more slowly than the male. It appears to stay near the water for a day or two, and disappears for several days before returning as the standard dark form. This would afford an explanation of the findings of 1959, which first started my speculations, and brings down the scales fairly heavily on the side of the theory that var. *aurantiaca* is a teneral form and not a variety at all. The probabilities are high, and if the proof is not yet incontrovertible, I hope that continuing observation and experiment over the next few years may make it so.

Finally, I would like to express my thanks once again to Miss C. Longfield, Miss E. M. Sheppard, Dr. B. W. Staddon and Dr. D. MacKinnon for their help and co-operation.

From a long series of *I. pumilio* collected at St. Martin de Crau, Camargue, S. France, 23.ix.1955, I have a female of the intermediate yellowish-grey colour preserved *in copula* with a normal coloured mature male.—A. E. GARDNER.

CHROMOSOME NUMBERS OF LEPIDOPTERA—PART II

By T. R. L. BIGGER

In the first part of this paper (1960, *Ent. Gaz.*, **11**: 149) I dealt with the techniques in preparing and the subsequent photographing of testis squashes for chromosome studies. The chromosome numbers of 25 species of Lepidoptera were given together with photomicrographs and drawings for each.

A further 12 species have been studied and their chromosome numbers are given in Table I. Photomicrographs (Plate I) and drawings (Text Figs. 1-12) are shown again with a magnification of X 1500. Preparation techniques were used identical with those described in PART I.

Species	n=haploid number	Species	n=haploid number
SATYRIDAE		HESPERIIDAE	
Pararge megera (L.)	27	*Thymelicus lineola* (Ochs.)	27
NYMPHALIDAE		NOCTUIDAE	
Argynnis paphia (L.)	29	*Amathes c-nigrum* (L.)	29
NEMEOBIIDAE		*Leucania impura* (Hübn.)	28
Hamearis lucina (L.)	29	*L. conigera* (Schiff.)	31
LYCAENIDAE		*Apamea monoglypha* (Hufn.)	29
Callophrys rubi (L.)	23	*Luperina testacea* (Schiff.)	29
Celastrina argiolus (L.)	24	PYRALIDAE	
		Haritala ruralis (Scop.)	41

TABLE I. Chromosome numbers of 12 species of Lepidoptera.

Some of the questions relating to Lepidoptera chromosomes and chromosome numbers will now be discussed, with special reference where possible to the thirty-seven examples cited.

Range of Chromosome Numbers

Lepidoptera tend to have high chromosome numbers in comparison with other groups of animals. Most Lepidoptera chromosome numbers fall between 23 and 62, whereas other animal groups have numbers between 6 and 20. Indeed, numbers above 20 and below 6 are rare. The second highest chromosome number recorded for an animal is that of the moth *Phigalia pedaria* (F.), with a haploid number of 112. Lepidoptera show the greatest range of numbers of all animal groups.

Within the chromosome number range there appear to be a few numbers or groups of numbers which occur more often, and these are referred to as 'type numbers'. In the Odonata, for example, one type number occurs, 13, which accounts for the majority of dragonfly species. In the Lepidoptera three type numbers are apparent; 23-24 group covers most of the Lycaenidae, 27 some of the Satyridae, whilst 29-31 covers a large range of species. Even the 37 examples I have studied show a similar trend. Most species with 'aberrant'

numbers, that is numbers which do not fall readily into any type number group, occur in the Geometridae, Notodontidae, Lymantriidae, Satyridae, Pieridae and Lycaenidae. These numbers have probably been evolved from ancestral species with numbers between 20 and 32, but it would be difficult to fix the original, or 'primitive' number as it is called, accurately. High and low numbers probably arose by a gradual evolutionary process rather than by sudden changes.

A new species may sometimes be produced by a series of abnormal cell divisions during the production of spermatozoa or ova, but even simple addition or deletion of chromosomes need not necessarily produce a new species. In this connection I have noted that more than one haploid number for a few Lepidoptera species has been given by some authors (Lorkovic, 1941); 25 or 26 has been quoted for *Pieris napi* (L.). I have looked at ten specimens of this species and all of them had a haploid chromosome number of 25. I intend to look further into this aspect of chromosome study next year. Chromosome studies upon the Roman Snail, *Helix pomatia* (L.), in which I have assisted, also bear out the fact that possession of extra or supernumerary chromosomes does not necessarily produce new species. In one wild population of the snail haploid numbers of 27 and 28 were found, as well as up to three chromosomal fragments in the majority of individuals. In fact snails with the normal n=27 were very infrequent. No striking morphological differences were detected between the specimens.

Chromosome Size and Shape

Lepidoptera chromosomes are very uniform in shape and appearance, and are seen at metaphase as spherical bodies which vary considerably in size from one another, though over so small a range as to appear negligible at first glance. Actually the variations in diameter are relatively large, and this is evident when cells are magnified several thousand times, though it is not so apparent from the photomicrographs. Even so one or two species, especially those with low haploid numbers, do show a range of chromosome sizes very well. (See Table II.)

Species	Diam. of the largest chromosome	Diam. of the smallest chromosome
Polyommatus icarus—meiotic division	1.5μ	0.9μ
Celastrina argiolus—mitotic division	1.1μ	0.5μ

μ=1/1000th mm.

TABLE II. The range of chromosome size of two species of Lepidoptera.

The figures given in Table II are an average of measurements of chromosomes of five cells. It was found that after allowing for differences in cell size, the relative differences in diameter of chromosomes were very consistent within each species. The differences in

diameter of the largest chromosome in a number of species are given in Table III.

Meiotic Cells		Mitotic Cells	
Species	Diameter	Species	Diameter
Lysandra coridon	1.8μ	*Eurrhypara hortulata*	1.2μ
Aglais urticae	1.6μ	*Agapetes galathea*	1.1μ
Polyommatus icarus	1.5μ	*Celastrina argiolus*	1.1μ
Perinephala coronata	1.4μ	*Pieris rapae*	0.8μ
Pararge megera	1.3μ	*Amathes c-nigrum*	0.7μ

TABLE III. Diameters of the Largest Chromosome of a number of Species of Lepidoptera.

As the chromosome shape is so uniform, the size can be used in close conjunction with chromosome numbers, especially, for example, to distinguish species which possess identical chromosome numbers. Hence in the following paragraphs both size and number will be considered together where possible.

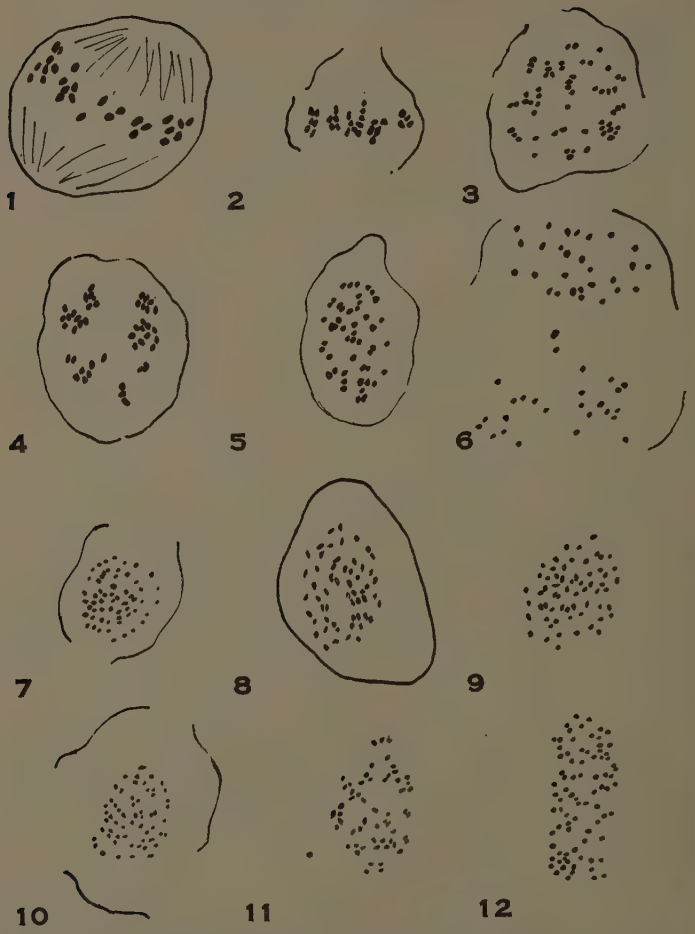
Differences in Chromosome Number and Size

(**a**) *Rhopalocera and Heterocera*: Butterfly chromosomes appear on the whole to be larger than moth chromosomes. This is evident both from Table III and the photomicrographs. On the other hand moths tend to have the higher chromosome numbers. Referring to my thirty-seven examples, the butterfly numbers all fall between 23-33 with only three exceptions. Moths range between 29-56, with most of the exceptions having numbers higher than 56. [As I have only 10 examples of moth chromosome numbers, I have based the above moth range on figures listed by White (1954) and other reference books.]

(**b**) *Lepidoptera families*: The various lepidoptera families show a definite trend towards a single type number or group of numbers. For example, the Lycaenidae are nearly all 23-24, the Satyridae 27-29, and the Nymphalidae 29. The chromosome size is of little importance in this case due to the large number of species involved.

(**c**) *Genera*: No hard and fast rule can be used here. Members of some genera tend to have the same chromosome number (e.g. *Pararge* n=27, *Pieris* n=29), but other genera have different numbers for each member (e.g. *Pieris* n=15 and 25). Again size variations are of little use.

(**d**) *Species*: Both within and without the different genera differences in actual number and size are closely related. Straight chromosome number differences are easily detected and can be used to separate closely related species, especially those which are very similar morphologically. But often closely related species have the same chromosome number, and it is in these cases that the actual size differences of the chromosomes play their most useful part. One example will suffice, though of course the two species in question



CHROMOSOMES OF LEPIDOPTERA

Figs. 1-12. 1, *Pararge megera* (L.)—Meiosis: 1st Metaphase n=27; 2, *Argynnis paphia* (L.)—Meiosis: 1st Metaphase n=29; 3, *Hamearis lucina* (L.)—Mitosis: Metaphase n=29; 4, *Callophrys rubi* (L.)—Mitosis: Metaphase n=23; 5, *Celastrina argiolus* (L.)—Mitosis: Metaphase n=24; 6, *Thymelicus lineola* (Ochs.)—Mitosis: Metaphase n=27; 7, *Amathes c-nigrum* (L.)—Mitosis: Metaphase n=29; 8, *Leucania impura* (Hübn)—Mitosis: Metaphase n=28; 9, *Leucania conigera* (Schiff.)—Mitosis: Metaphase n=31; 10, *Apamea monoglypha* (Hufn.)—Mitosis: Metaphase n=29; 11, *Luperina testacea* (Schiff.)—Mitosis: Metaphase n=29; 12, *Haritala ruralis* (Scop.)—Mitosis: Metaphase n=41.

Chromosomes of Lepidoptera. Photomicrographs X1500.
For Key see opposite page.

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To face page 88.

can easily be separated morphologically. Using *Parage aegeria* and *P. megera,* both with n=27, it will be apparent from the photomicrographs that the chromosomes of *P. megera* are larger.

Hybrids

Finally a few words on hybrids and hybridization which form a subject in themselves. Interspecific and intergeneric hybrids are found fairly often in captivity. With respect to chromosome numbers, they occur either when the haploid number is the same when complete pairing of the chromosomes at meiosis can take place, or sometimes when incomplete chromosomal pairing takes place. The latter are always sterile, no germ cells being produced, though the actual fact that pairing is incomplete does not necessarily upset the production of a hybrid, or render the original cross lethal.

The majority of hybrid crosses will produce lethal chromosome pairings by upsetting the chromosome balance at meiosis to such an extent that subsequent cell division is inhibited.

Summary

1. Testis squashes of 37 Lepidoptera were made and studied.
2. Meiotic and mitotic metaphase cells were scored and a table of chromosome numbers given.
3. Some questions regarding chromosome numbers and size are discussed.

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A FURTHER RECORD OF *SYNAGELES VENATOR* (LUC.) (ARANEAE, SALTICIDAE)

By M. J. COTTON AND J. A. L. COOKE

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Three specimens of this ant-mimic, *Synageles venator* (Luc.), 1 ♂, 1 ♀, and 1 immature, were taken at Whiteford Burrows, near Llanmadoc, on the north coast of the Gower Peninsula, on 9th April, 1960. This is a large stretch of sand dunes and many species of insects and spiders were taken from the dense tufts of marram grass (*Ammophila arenaria* (L.)). At the bases of these plants there was much decaying organic matter and it was from such an environment that the majority of species were recorded. Here the relative humidity is far higher than over the more exposed portions of the dunes, an important factor in the ecology of these Arthropods.

Synageles venator (Luc.) showed great similarities both in appearance and behaviour to the ants, *Lasius niger* (L.) and *L. fuliginosus* (Latr.), that occurred in this locality, and many of the party of collectors on the dunes were easily deceived. The colour, dark brown to black, and size 3-4 mm., were similar in both spider and ants, and two broad, curved white lines across the centre of the abdomen of the spider gave it the appearance of an ant petiole. The forelegs were held in front of the head and gave the impression of antennae as the spider darted very rapidly, in ant-like manner, across the surface of the sand.

This rare British spider was first taken at Charmouth, Dorset, in 1885, by C. W. Dale (Pickard-Cambridge, 1886), and again from this locality in June, 1926. Numerous specimens were taken on sand and under the sedge in company with workers of *Myrmica scabrinodis* Nyl. and *Lasius niger* (L.) (Donisthorpe, 1926). Jackson (1906b) recorded two immature males in October, 1901, from sandhills in Aberavon, Glam., and later, in June, 1923, he took two adult males, twelve adult females and immature specimens at Tenby in Pembrokeshire (Jackson, 1925b). In this paper he states that this spider inhabits stalks of dead marram grass, and that its elongate narrow shape makes this a convenient habitat. It is unable to jump, but runs backwards and forwards with equal facility. Rest cocoons and egg sacs are formed inside the stalks of marram grass. Bristowe (1939) also records this spider from Hunts. (Yaxley Fen) and Devon (Braunton Burrows), and states that it not only occurs on sandhills but also in damp and marshy areas. Wild (1952) took this species from the same locality as myself (M.J.C.), in May, 1948, and both sexes from sandhills at Towyn Burrows (Kidwelly), Carmarthenshire, in May, 1950. He has seen males hunting in the open on sand-dunes in this county, and also on a stony ledge on the sea cliffs at Lyme Regis, Dorset, in the early summer of 1951. *Synageles* was in company with the other ant-like Salticid, *Myrmarachne formicaria*

(Degeer) and with ants. In May, 1954, he recorded specimens from Braunton Burrows (Wild, 1955). It is noticeable that the majority of records are from April to June, and that only the single record from Aberavon, in 1901, indicates that this species is active during the winter months.

OTHER SPECIES RECORDED

With the exception of *Theridion ovatum* (Clerck), which was collected on *Salix repens* L. on the dune slacks, all the following species were taken by M.J.C. from under marram grass either at the junction between fixed and mobile dunes, or at the edge of the dune slacks at Whiteford Burrows. Identifications were made by J.A.L.C. An asterisk (*) denotes a new county record.

9.iv.1960	*Drassodes* spp.	imm.
	Zelotes spp.	imm.
	Clubiona phragmitis C. L. Koch	♂, ♀, imms.
	Cheiracanthium erraticum (Walck.)	♀.
	Xisticus sp.	imm.
	Tibellus sp.	imm.
	Synageles venator (Luc.)	♂, ♀, imm.
	Lycosa monticola (Clerck)	imm.
	L. tarsalis herbigrada Bl.	imm.
	Arctosa perita (Latr.)	♀, imm.
	Pachygnatha degeeri Sund.	imm.
	**Troxochrus scabriculus* (Westr.)	♂.
	**Centromerita concinna* (Thor.)	♀.
	Lepthyphantes tenuis (Bl.)	♂♂.
29.vii.1960	*Zelotes electus* (C. L. Koch)	♂.
	Agroeca proxima (O.P.—C.)	♂♂.
	Tibellus maritimus (Menge)	imms.
	Lycosa spp.	imms.
	Arctosa perita (Latr.)	imms.
	Euophrys frontalis (Walck.)	♀.
	Araneus redii (Scop.)	imm.
	Theridion ovatum (Clerck)	imms.
	T. bimaculatum (L.)	♀♀.
	Oedothorax fuscus (Bl.)	♀.
	Lepthyphantes tenuis (Bl.)	♀.

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ABUNDANCE OF LEPIDOPTERA IN EARLY MARCH

The nights of 7th to 10th March were remarkably productive for my garden mercury vapour trap. Twenty-two species of Macrolepidoptera and eight species of Microlepidoptera were noted. Numbers of moths varied from just over 200 on the poorest night to over 680 on the best night. The species seen were: Macros—*A. flavicornis* L. (Yellow Horned), *O. gothica* L. (Hebrew Character), *O. miniosa* Schiff. (Blossom Underwing), *P. flammea* Schiff. (Pine Beauty), *O. cruda* Schiff. (Small Quaker), *O. stabilis* Schiff. (Common Quaker), *O. incerta* Hufn. (Clouded Drab), *O. munda* Schiff. (Twin-spotted Quaker), *O. gracilis* Schiff. (Powdered Quaker), *C. rubricosa* Schiff. (Red Chestnut), *X. areola* Esp. (Early Grey), *C. vaccinii* L. (Chestnut), *S. libatrix* L. (Herald), *A. aescularia* Schiff. (March Moth), *N. carpinata* Bork. (Early Tooth-striped), *E. badiata* Schiff. (Shoulder Stripe), *E. marginaria* F. (Dotted Border), *B. strataria* Hufn. (Oak Beauty), *E. bistortata* Goeze (Engrailed), *A. hispidaria* Schiff. (Small Brindled Beauty), *L. hirtaria* Clerck (Brindled Beauty), *E. abbreviata* Steph. (Brindled Pug). And Micros.—*Tortricodes tortricella* Hübn., *Acleris hastiana* L., *A. cristana* Schiff., *Semioscopis avellanella* Hübn., *Depressaria heracliana* Degeer, *Depressaria* spp. (Two species not identified), and *Cerostoma radiatella* Don.

O. gracilis, which appeared on the night of 9th March, was exceptional even in this very early season. Normally I see it from mid to end April into May.

Mr. J. L. Messenger, who lives some four miles away, has authorized me to say that he took three further species during the above period. Those are: *O. populeti* F. (Lead Coloured Drab), *L. socia* Hufn. (Pale Pinion), and *D. rubiginea* Schiff. (Dotted Chestnut).

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BOOK REVIEW

Introduction to Entomology, by R. Jeannel, translated by Harold Oldroyd, London, 1960. pp. 344. Illustrated. Cloth. Hutchinson. Price £3 3s.

This is a translation of the French work *Introduction a l'Entomologie,* which was published in 1955. The book is divided into three sections: Anatomy and Classification, Biology, and Palaeontology and Distribution.

In the first section the part on anatomy is well presented with an original and stimulating approach, partly due to the emphasis placed on unusual topics, and partly because the examples are not those with which we have become familiar through a limited number of English textbooks, and an unlimited number of rehashes of them. The part dealing with classification is particularly lucid and thorough, the author following the system derived from the work of Lameere and Martynox—a system which will probably find favour with British entomologists eventually.

The Apterygote orders of Imms (1957) are all given sub-class rank, the Thysanura being divided into two orders. The Pterygota are divided into four sections and then into super-orders. Other differences are that the Ephemeroptera, Grylloblattodea, Phasmida and Siphunculata of Imms are referred to as the Plectoptera, Notoptera, Cheleutoptera, and Anoplura respectively. The Neuroptera are divided into three orders, the Megaloptera, Raphidioptera and Planipennia, and the Homoptera and Heteroptera are given ordinal rank. The inclusion of fossil orders is a welcome innovation in a work of this kind, as is the section on insect palaeontology, a realm which is a closed book to most entomologists, chiefly one suspects, because of the lack of available information on the subject.

The section dealing with biology is, however, grossly inadequate. The title of the book suggests that it is intended for beginners and students, and the first requisite of such a book is that it should be free of misleading or ambiguous statements. It should also be free from dogmatic statements based on the author's opinion and not on the facts. Apart from factual errors, much of the writing, especially in in the chapters on behaviour and physiology is 'woolly' and could easily give rise to many erroneous ideas to a reader not already acquainted with the subject under discussion. Much of this is possibly due to the translation, but other faults (of which there are many) can only be laid at the door of the author. Consider the following:

'Dragonfly larvae . . . clothe themselves in a covering of fragments of debris to disguise their appearance and so practise a true camouflage.'

'Homochroism proceeds only in sedentary animals.'

'. . . the processionary caterpillars . . . become solitary as adult butterflies.'

'Hemiptera, however, will bite if they are picked up, and most entomologists have suffered the shooting pain of a bite from . . . a corixid.'

'Except in *Melöe*, the elytra [of Coleoptera] meet in the middle line without overlapping.'

Examples of such inaccuracies could be multiplied considerably, and it would be a relief if the author (or translator) could make up his mind whether the plural of urogomphus is urogomphi, urogomphae or urogomphs, and whether the beetle depicted in figure 76 is called *Pachypus candidae* or *P. cornutus*. Minor misprints and errors are few, though one wonders how such things as 'A carabid larvae' (p. 191), 'Elator' (p. 78), and 'Hygobia' (p. 127) crept past the proof readers.

On page 221 the author states that the fungi growing in the nests of termites are unwanted parasites. This theory, never on a firm foundation, has been conclusively disproved by several authors, including Sands (1956). It is, however, on his theories on colouration that the author lays himself most open to criticism.

He rejects the theory of natural selection to account for the evolution of cryptic and aposematic colouration and mimicry, invoking hypertely to account for 'resemblances so minute that it is hard to see what selective value there could be in the finer details. Of what use can it be to suggest the attacks of parasites by details so small that they can be seen only with a magnifying glass? This perfection of detail is a useless embellishment'.

This specious argument has, of course, been raised before, e.g. by Lull (1917), and has been amply answered by Cott and others. Belt (1888) makes the point that 'Natural selection not only tends to pick out and preserve the forms that have protective resemblances, but to increase the perceptions of the predatory species of insects and birds. . . .' Indeed, Jeannel himself refers (p. 130) to the 'kind of fraud which may deceive the imperfect observation of human beings, but surely . . . will not deceive the more acute vision of a bird'.

To account for cryptic colouration Jeannel postulates that in any given species the environment, acting via the eyes, will produce a camouflage effect directly, and draws on the chameleon as an analogy: 'The chameleon during its lifetime reproduces on its skin the effect of colour and pattern that its eyes see around it. All animals do this, but on a different time scale, not during the lifetime of a single individual, but in the course of evolution of a species.' Having produced this unorthodox theory he fails to back it with any reasonable evidence, and terminates the discussion rather lamely by invoking the Lamarkian idea, that 'variations acquired during the life of an individual can be inherited somehow or other'. Unsurprisingly he does not say how! I do not see how any biologist with the example of the recent spread of industrial melanism before him, backed by the careful and painstaking work of Kettlewell and others, could

possibly doubt the large part played by natural selection in the evolution of cryptic colouration.

Writing of mimicry, Jeannel has this to say: 'In the first place let us get rid of the idea that striking colour and pattern can really serve warning to insectivorous animals, and drive them away.' On page 168 he exhorts us to be on our guard against anthropomorphism. On page 179, discussing the close resemblance between some parasites and their hosts (e.g. *Volucella*) he writes, '. . . can we really believe that the bees and wasps are so easily deceived? . . . We cannot imagine that the mimicry can be good enough to deceive'. In the absence of any experimental evidence, if this is not anthropomorphic thinking I should like to know what is.

It is difficult to see how the overwhelming amount of evidence which exists in favour of the very real value of aposematic and pseudaposematic colouration can be so lightly rejected. The theory was put on a firm footing by the work of Carpenter, Poulton and Cott many years ago and there has been a good deal of recent work on the subject. Morgan (1896-1900), studying learning in chicks, demonstrated that they can associate distasteful food with particular colour and pattern, and that they would subsequently reject artificial 'mimics' of the same colour or pattern. Mostler (1935) showed that birds learned to avoid wasps and would also reject like coloured, but harmless, insects. Darlington (1938), experimenting with *Anolis* lizards, found that they rejected beetles of unpleasant taste, and also mimics of these species. More recently Blest (1957) has demonstrated the value of the eyespots of certain Lepidoptera, and Brower (1958) has conclusively shown the effectiveness of mimicry in several species of North American butterflies.

However, Jeannel prefers the explanation that mimetic resemblances are evolutionary convergences, produced by life under similar environmental influences, an argument which is hardly convincing. Animals which inhabit the same geographical regions do not necessarily live in identical environments. The influences to which a wasp is subjected are not those to which a longicorn beetle is exposed. Moreover mimetic resemblances imply similarities only in superficial appearance; the colour of the model may be due to pigment, while that of the mimic is structural, or both may be due to pigment but of different chemical nature. Furthermore, many mimics do not even take the shape of the model but merely have a pattern on their body which resembles the model. It is also now known that in some butterflies several different mimetic forms can arise in the same brood, under identical environmental conditions, and that this is genetically controlled.

The book ends with a section on distribution which is eminently readable, as is the whole of the work. The text-figures, of which there are many, are of a very high standard, but the eleven colour plates have a rather antiquated look about them. The index is inadequate and, far more serious, there is no bibliography; indeed, refer-

ences of any sort are very few. On the whole one feels that this book, which could have filled a very real gap between dry, academic textbooks and trite popular works, fails to make the grade.

A. EVE.

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DYSGONIA ALGIRA L. (LEP., NOCTUIDAE) AND *EUPITHECIA PHOENICIATA* RAMBUR (LEP., GEOMETRIDAE) IN JERSEY IN 1960

On 25th August, 1960, while using a mercury vapour lamp in the grounds of Samarès Manor, Jersey, Mr. J. H. Richards took one specimen of what was evidently an exotic moth. The reference books then at our disposal being inadequate, the moth was taken to the British Museum (Natural History), where Mr. D. S. Fletcher identified it as *Dysgonia algira* L. This is a predominantly Mediterranean species which has not been previously recorded for any of the Islands nor, as far as we know, for Great Britain. The moth, which had suffered somewhat from the attentions of the numerous bats, is now in the collection of La Société Jersiaise.

Also during 1960 several specimens of *Eupithecia phoeniciata* Rambur were taken by Mr. J. H. Richards, Mrs. M. L. Long and the writer. In view of its fairly recent discovery in England we think this record may be of interest. At least six moths, which all came to light, were collected or seen in two localities about four miles apart between 31st August and 10th September. This also is the first record for the Channel Islands and a series is now in the museum collection. Unfortunately, we are unable to say whether or not *Eupithecia phoeniciata* Ram. was to be found before 1960, as serious study of the Heterocera was resumed only last summer.

R. LONG.

Jersey, Channel Islands.

REVISED INDEXED CHECK-LIST OF THE BRITISH LEPIDOPTERA

By I. R. P. HESLOP, M.A.

PART II

(*Continued from* Vol. 11, p. 234)

Super-family TORTRICOIDEA

PHALONIIDAE

PHALONIINAE

*1195 **Hysterosia inopiana** Haw.
Plain Conch

1196 **Hysterosia sodaliana** Haw.
(*amandana* H.-S.)
Brindled Marbled Conch

1197 **Hysterosia schreibersiana** Fröl.
Schreber's Conch

1198 **Hysterosia maculosana** Haw.
Small Black-spotted Conch

*1199 **Acornutia nana** Haw.
Barred Dwarf Conch

*1200 **Commophila aeneana** Hübn.
Silvery Broad-barred Conch

*1201 **Clysia ambiguella** Hübn.
Small Brown-barred Conch

*1202 **Eupoecilia angustana** Hübn.
(*thuleana* Vaugh.)
Barred Marbled Conch

*1203 **Lozopera francillana** F.
Francillon's Carrot Conch

1204 **Lozopera dilucidana** Steph.
Yellow Short-barred Conch

1205 **Lozopera beatricella** Wals.
Double-line Conch

*1206 **Chlidonia hartmanniana** Clerck
(*baumanniana* Schiff.)
Baumann's Conch

1207 **Chlidonia piercei** Obraztsov
(*baumanniana* Pierce *nec* Schiff.)
Rusty-clouded Conch

*1208 **Aethes smeathmanniana** F.
Smeathman's Conch

*1209 **Phalonia cnicana** Westw.
Barred Thistle Conch

1210 **Phalonia rubigana** Treits.
(*badiana* Hübn. *nec* Schiff.)
Chestnut Conch

1211 **Phalonia rutilana** Hübn.
Barred Gold Conch

1212 **Phalonia tesserana** Schiff.
(*tessellana* Hübn.)
Tessellated Conch

1213 **Phalonia margaritana** Haw.
(*dipoltella* Hübn.)
Orange-barred Conch

1214 **Phalonia maritimana** Guen.
Dover Lazy Conch

1215 **Phalonia williana** Brahm
(*zephyrana* Treits.)
Silvered Carrot Conch

*1216 **Eugnosta lathoniana** Hübn.
Silver-spotted Conch

*1217 **Agapeta hamana** L.
Hook-marked Conch

1218 **Agapeta zoegana** L.
Zoega's Conch

*1219 **Cochylichroa atricapitana** Steph.
Black-headed Conch

*1220 **Phtheochroa rugosana** Hübn.
(*v-albana* Don.)
Rough-winged Conch

*1221 **Phalonidia affinitana** Dougl.
(*cancellana* Zell.)
Allied Marbled Conch

1222 **Phalonidia manniana** F.R.
(*notulana* Zell.)
Clouded Oblique-barred Conch

1223 **Phalonidia walsinghamana** Pierce
(*geyeriana* auct. *nec* H.-S.)
Fen Conch

1224 **Phalonidia griseana** Haw.
(*vectisana* Westw.)
Isle of Wight Conch

1225 **Phalonidia luridana** Gregs.
(*manniana* Meyr. *nec* F.R.)
Bank Conch

1226 **Phalonidia alismana** Rag.
(*udana* Meyr. *nec* Guen.)
Oblique-barred Grey Conch

1227 **Phalonidia permixtana** Schiff.
(*mussehliana* Treits.)
Recovered Conch

*1228 **Brevisociaria gilvicomana** Zell.
Wall-lettuce Conch

1229 **Brevisociaria curvistrigana** Staint.
Strong-barred Conch

*1230 **Cochylidia implicitana** Wocke
(*anthemidana* Wilk.)
Chamomile Conch

1231 **Cochylidia erigerana** Wals.
(*sabulicola* Wals.)
Erigeron Conch

1232 **Cochylidia subroseana** Haw.
Dingy Roseate Conch

1233 **Cochylidia rupicola** Curt.
Chalk-cliff Conch

*1234 **Falseuncaria ruficiliana** Haw.
(*ciliella* Hübn. *nec* Schiff.)
Red-fringed Conch

1235 **Falseuncaria degreyana** McLach.
Pink-edged Conch

*1236 **Cochylis pallidana** Zell.
(*albicapitana* Cooke)
Pale Coast Conch

1237 **Cochylis dubitana** Hübn.
Doubtful Dwarf Conch

1238 **Cochylis hybridella** Hübn.
(*carduana* Zell.)
False Thistle Conch

1239 **Cochylis roseana** Haw.
Rosy Conch

1240 **Cochylis flaviciliana** Westw.
Yellow-fringed Conch

*1241 **Stenodes straminea** Haw.
Straw Short-barred Conch

1242 **Stenodes alternana** Steph.
(*gigantana* Guen.)
Alternate-barred Conch

TORTRICIDAE

ARCHIPINAE

*1243 **Pandemis corylana** F.
Great Chequered Twist

1244 **Pandemis cinnamomeana** Treits.
Cinnamon Twist

1245 **Pandemis heparana** Schiff.
Dark Oblique-barred Twist

1246 **Pandemis cerasana** Hübn.
(*ribeana* Hübn.)
Currant Twist

1247 **Pandemis dumetana** Treits.
Thicket Twist

*1248 **Argyrotaenia pulchellana** Haw.
(*politana* Haw.)
Grey Red-barred Twist

*1249 **Choristoneura diversana** Hübn.
(*transitana* Guen.)
Maple Twist

1250 **Choristoneura lafauryana** Rag.
Atmore's Twist

*1251 **Archips piceana** L.
Pine Hook-tipped Twist

1252 **Archips oporana** L.
(*podana* Scop.)
Great Brown Twist

1253 **Archips decretana** Treits.
Lynn Twist

1254 **Archips crataegana** Hübn.
(*roborana* Hübn.)
Oak Red-barred Twist

1255 **Archips xylosteana** L.
Forked Red-barred Twist

1256 **Archips rosana** L.
Rose Twist

1257 **Archips hebenstreitella** Müll.
(*sorbiana* Hübn.)
Hazel Twist

*1258 **Cacoecimorpha pronubana** Hübn.
Carnation Twist

*1259 **Syndemis musculana** Hübn.
Afternoon Twist

*1260 **Austrotortrix postvittana** Walk.
Walker's Euonymus Twist

*1261 **Ptycholomoides aeriferana** H.-S.
Larch Twist

*1262 **Amelia viburnana** Schiff.
(*donelana* Carp.)
Bog-myrtle Twist

1263 **Amelia paleana** Hübn.
(*icterana* Fröl.)
Plain Yellow Twist

*1264 **Clepsis senecionana** Hübn.
(*rusticana* Treits.)
Rustic Twist

1265 **Clepsis rurinana** L.
(*semialbana* Guen.)
Modée's Twist

1266 **Clepsis consimilana** Hübn.
(*croceana* Haw. *nec* Hübn.)
Saffron Twist

1267 **Clepsis costana** F.
(*latiorana* Staint.)
Straw Oblique-barred Twist

*1268 **Adoxophyes orana** F.R.
Summer Fruit Twist

*1269 **Ptycholoma lecheana** L.
Leche's Twist

*1270 **Lozotaenia forsterana** F.
(*adjunctana* Treits.)
Forster's Twist

*1271 **Lozotaeniodes formosana** Fröl.
Beautiful Twist

*1272 **Paramesia gnomana** Clerck
Lost Twist

*1273 **Paraclepsis cinctana** Schiff.
Dover Twist

*1274 **Epagoge grotiana** F.
Grote's Twist

*1275 **Capua vulgana** Fröl.
(*ochraceana* Steph.)
Ochreous Twist

*1276 **Philedone gerningana** Schiff.
Gerning's Twist

*1277 **Philedonides prodromana** Hübn.
(*walkerana* Curt.)
Walker's Heath Twist

*1278 **Batodes angustiorana** Haw.
Narrow Red-barred Twist

CNEPHASIINAE

*1279 **Pseudargyrotoza conwagana** F.
Conway's Shade

*1280 **Olindia schumacherana** F.
(*ulmana* Hübn.)
Streamlet Shade

*1281 **Isotrias trifasciana** Don.
(*hybridana* Wilk. *nec* Hübn.)
Barred Elm Shade

*1282 **Eulia ministrana** L.
Yellow-barred Shade

*1283 **Cnephasia conspersana** Dougl.
(*perterana* Doubl.)
Coast Grey Shade

1284 **Cnephasia longana** Haw.
(*ictericana* Haw.)
Long-winged Shade

1285 **Cnephasia gueneana** Dup.
Anemone Shade

1286 **Cnephasia pasiuana** Hübn.
(*pascuana* Hübn.)
Meadow Shade

1287 **Cnephasia chrysantheana** Dup.
(*alternella* Wilk.)
Greater Grey Shade

1288 **Cnephasia octomaculana** Curt.
Eight-spotted Shade

1289 **Cnephasia communana** H.-S.
Bond's Shade

1290 **Cnephasia interjectana** Haw.
(*virgaureana* Treits.)
Lesser Grey Shade

1291 **Cnephasia genitalana** Pierce
Dover Grey Shade

*1292 **Cnephasiella incertana** Treits.
(*subjectana* Guen.)
Allied Shade

1293 **Cnephasiella abrasana** Dup.
Bristol Shade

*1294 **Tortricodes tortricella** Hübn.
(*hyemana* Hübn.)
Clouded Winter Shade

*1295 **Exapate congelatella** Clerck
(*gelatella* L.)
Autumnal Shade

*1296 **Neosphaleroptera nubilana** Hübn.
Deep Brown Shade

*1297 **Eana incanana** Steph.
(*sinuana* auct.)
Waved Shade

1298 **Eana penziana** Thunb.
(*bellana* Curt.)
Pentz's Shade

1299 **Eana colquhounana** Barr.
Mottled Coast Shade

1300 **Eana osseana** Scop.
(*pratana* Hübn.)
Dotted Shade

1301 **Eana argentana** Clerck
Silver Shade

TORTRICINAE

*1302 **Aleimma loeflingiana** L.
Loefling's Curl

*1303 **Tortrix viridana** L.
Pea-green Oak Curl

ACLERINAE

*1304 **Croesia forskaleana** L.
Forskal's Button

1305 **Croesia bergmanniana** L.
Bergmann's Button

*1306 **Spatalistis bifasciana** Hübn.
(*audouinana* Dup.)
Audouin's Button

*1307 **Acleris comariana** Zell.
(*proteana* H.-S.)
Strawberry Button

1308 **Acleris potentillana** Cooke
Gregson's Button

1309 **Acleris schalleriana** L.
(*logiana* Schiff. *nec* Clerck)
Logan's Button

1310 **Acleris latifasciana** Haw.
(*schalleriana* Meyr. *nec* L.)
Broad-barred Button

1311 **Acleris perplexana** Barr.
Perplexed Button

1312 **Acleris comparana** Hübn.
Costal-dotted Button

1313 **Acleris caledoniana** Steph.
Caledonian Button

1314 **Acleris aspersana** Hübn.
Subtriple-spot Button

1315 **Acleris maccana** Treits.
Marbled Button

1316 **Acleris variegana** Schiff.
Common Rough-winged Button

1317 **Acleris permutana** Dup.
Buff Rough-winged Button

1318 **Acleris hyemana** Haw.
(*mixtana* Hübn.)
Chestnut Button

1319 **Acleris lipsiana** Schiff.
Kindred Button

1320 **Acleris rufana** Schiff.
(*autumnana* Hübn.)
Double Bay-streaked Button

1321 **Acleris sparsana** Schiff.
(*sponsana* F.)
Ashy Button

1322 **Acleris hastiana** L.
Hast's Button

1323 **Acleris cristana** Schiff.
White-tufted Button

1324 **Acleris niveana** F.
(*scotana* Steph.)
Scotch Button

1325 **Acleris umbrana** Hübn.
Dark-streaked Button

1326 **Acleris lorquiniana** Dup.
(*uliginosana* Westw.)
Darkling Bog Button

1327 **Acleris holmiana** L.
Stockholm Button

1328 **Acleris boscana** F.
(*scabrana* Steph.)
Bosc's Button

1329 **Acleris ferrugana** Schiff.
(*fissurana* Pierce)
Rusty Button

1330 **Acleris tripunctana** Hübn.
(*ferrugana* Treits. *nec* Schiff.)
Treble-spot Button

1331 **Acleris shepherdana** Steph.
Shepherd's Button

1332 **Acleris rhombana** Schiff.
(*contaminana* Hübn.)
Chequered Pebble Button

1333 **Acleris emargana** F.
(*caudana* F.)
Notch-wing Button

1334 **Acleris literana** L.
Sprigged Green Button

SPARGANOTHINAE

*1335 **Sparganothis pilleriana** Schiff.
Striped Comb

OLETHREUTIDAE

DICHRORAMPHINAE

*1336 **Dichrorampha petiverella** L.
Petiver's Drill

1337 **Dichrorampha alpinana** Treits.
(*quaestionana* Zell.)
Jacquin's Drill

1338 **Dichrorampha flavidorsana** Knaggs
(*alpinana* Meyr. *nec* Treits.)
Plain Silver-fringed Drill

1339 **Dichrorampha gueneeana** Obraztsov
(*politana* Guen.)
Plain Gold-fringed Drill

1340 **Dichrorampha plumbagana** Treits.
Leaden-fringed Drill

1341 **Dichrorampha senectana** Guen.
(*cinerosana* H.-S.)
Dark Silver-fringed Drill

1342 **Dichrorampha sequana** Hübn.
Silver Blotch-backed Drill

1343 **Dichrorampha acuminatana** Zell.
Sharp-winged Drill

1344 **Dichrorampha consortana** Steph.
(*distinctana* Barr. *nec* Hein.)
Wilkinson's Drill

1345 **Dichrorampha simpliciana** Haw.
(*caliginosana* Treits.)
Purple-black Drill

1346 **Dichrorampha pseudoalpestrana** Danil.
(*alpestrana* Staint. *nec* H.-S.)
Sneezewort Drill

1347 **Dichrorampha montanana** Dup.
(*tanaceti* Staint.)
Spike-marked Drill

1348 **Dichrorampha plumbana** Scop.
(*ulicana* Guen.)
Lead-coloured Drill

1349 **Dichrorampha saturnana** Guen.
Dingy Drill

1350 **Dichrorampha aeratana** Pierce
Threlfall's Drill

LASPEYRESIINAE

*1351 **Laspeyresia succedana** Schiff.
(*ulicetana* Haw.)
Light Striped-edge Piercer

1352 **Laspeyresia nigricana** F.
(*proximana* Haw.)
Black Striped-edge Piercer

1353 **Laspeyresia cosmophorana** Treits.
Obscure Silver-striped Piercer

1354 **Laspeyresia leguminana** Zell.
(*interruptana* Wilk.)
Eastern Elm Piercer

1355 **Laspeyresia gallicana** Guen.
(*rufillana* Doubl.)
Dark Purple-shaded Piercer

1356 **Laspeyresia aurana** F.
(*mediana* Hübn.)
Double Orange-spot Piercer

1357 **Laspeyresia servillana** Dup.
Serville's Piercer

1358 **Laspeyresia corollana** Hübn.
(*heegerana* Wilk. *nec* Dup.)
Heeger's Whittlesea Piercer

1359 **Laspeyresia conicolana** Heylaerts
New Forest Piercer

1360 **Laspeyresia zebeana** Ratz.
Larch-gall Piercer

1361 **Laspeyresia pomonella** L.
Codlin Piercer

1362 **Laspeyresia coniferana** Sax.
Fir Crescent Piercer

1363 **Laspeyresia cognatana** Barr.
(*pactolana* auct.)
Cognate Piercer

1364 **Laspeyresia fagiglandana** Zell.
(*grossana* Haw.)
Smoky Marbled Piercer

1365 **Laspeyresia splendana** Hübn.
Splendid Piercer

*1366 **Pseudotomoides strobilella** L.
Light Silver-striped Piercer

*1367 **Collicularia microgrammana** Guen.
Rest-harrow Piercer

*1368 **Grapholita gemmiferana** Treits.
Lead-streaked Piercer

1369 **Grapholita janthinana** Dup.
(*lediana* Haw.)
Ledum Piercer

1370 **Grapholita tenebrosana** Dup.
(*roseticolana* Zell.)
Brown Striped-edge Piercer

1371 **Grapholita funebrana** Treits.
Plum Piercer

1372 **Grapholita molesta** Busck
Oriental Peach Piercer

1373 **Grapholita prunivorana** Rag.
Orchard Piercer

1374 **Grapholita lathyrana** Hübn.
(*scopariana* H.-S.)
Black-dash Piercer

1375 **Grapholita jungiella** L.
(*perlepidana* Haw.)
Beautiful Crescent Piercer

1376 **Grapholita dorsana** F.
Scarce Crescent Piercer

1377 **Grapholita orobana** Treits.
Wild-flying Piercer

1378 **Grapholita caecana** Schläg.
Kentish Piercer

1379 **Grapholita compositella** F.
Triple-striped Piercer

1380 **Grapholita internana** Guen.
(*erectana* Barr.)
Dark Crescent Piercer

1381 **Grapholita pallifrontana** Zell.
Milk-vetch Piercer

*1382 **Pammene splendidulana** Guen.
Grey Silver-barred Piercer

1383 **Pammene obscurana** Steph.
Scarce Obscure Piercer

1384 **Pammene inquilina** Fletch.
(*fimbriana* Haw.)
Brown-bordered Piercer

1385 **Pammene argyrana** Hübn.
(*vernana* Knaggs)
Black-bordered Piercer

1386 **Pammene albuginana** Guen.
(*gallicolana* Zell.)
Obscure Blotched Piercer

1387 **Pammene spiniana** Dup.
Triangle-marked Piercer

1388 **Pammene populana** F.
(*ephippana* Hübn.)
Pigmy Y Piercer

1389 **Pammene aurantiana** Staud.
Sycamore Piercer

1390 **Pammene regiana** Zell.
Traun's Regal Piercer

1391 **Pammene trauniana** Schiff.
Traun's Black-and-white Piercer

1392 **Pammene fasciana** L.
(*juliana* Curt.)
July Acorn Piercer

1393 **Pammene nimbana** H.-S.
May Beech Piercer

1394 **Pammene herrichiana** Hein.
Orange-patch Piercer

1395 **Pammene germmana** Hübn.
(*puncticostana* Wilk.)
Sector-spotted Piercer

1396 **Pammene ochsenheimeriana** Zell.
Black-patch Piercer

1397 **Pammene rhediella** Clerck
Rheede's Small Piercer

*1398 **Strophedra weirana** Dougl.
Weir's Piercer

1399 **Strophedra nitidana** F.
(*redimitana* Guen.)
Dark Silver-striped Piercer

*1400 **Lathronympha strigana** F.
(*hypericana* Hübn.)
Yellow Striped-edge Piercer

*1401 **Selania leplastriana** Curt.
Leplastrier's Piercer

*1402 **Eucosmomorpha albersana** Hübn.
(*rheediana* Haw. *nec* L.)
Rheede's Large Piercer

*1403 **Enarmonia formosana** Scop.
(*woeberiana* Schiff.)
Woeber's Piercer

SPILONOTINAE

*1404 **Rhyacionia buoliana** Schiff.
Gemmed Shoot

1405 **Rhyacionia pinivorana** Zell.
Spotted Shoot.

1406 **Rhyacionia hastana** Hübn.
Hast's Shoot

1407 **Rhyacionia pinicolana** Doubl.
Orange-spotted Shoot

1408 **Rhyacionia logaea** Durr.
(*duplana* Meyr. *nec* Hübn.)
Elgin Shoot

1409 **Rhyacionia duplana** Hübn.
Double Shoot

1410 **Rhyacionia retiferana** Wocke
Wish-bone Shoot

*1411 **Clavigesta sylvestrana** Curt.
Pine Shoot

1412 **Clavigesta purdeyi** Durr.
Purdey's Shoot.

*1413 **Petrova resinella** L.
Resin-gall Shoot

*1414 **Pseudococcyx posticana** Zett.
(*duplana* Staint. *nec* Hübn.)
Warren's Shoot

1415 **Pseudococcyx turionella** L.
(*turionana* Hübn.)
Pale Orange-spot Shoot

*1416 **Spilonota ocellana** Schiff.
Cream-cloak Apple Shoot

1417 **Spilonota laricana** Hein.
(*lariciana* auct.)
Larch Shoot

EUCOSMINAE

*1418 **Thiodia citrana** Hübn.
Lemon Bell

*1419 **Eucosma hohenwartiana** Schiff.
(*scopoliana* Haw. *nec* Schiff.)
Scopoli's Bell

1420 **Eucosma parvulana** Wilk.
Bond's Bell

1421 **Eucosma fulvana** Steph.
Fulvous Sealed Bell

1422 **Eucosma cana** Haw.
(*scopoliana* Wilk.)
Hoary Sealed Bell

1423 **Eucosma expallidana** Haw.
Pale Drab Bell

1424 **Eucosma aspidiscana** Hübn.
Spotted Goldenrod Bell

1425 **Eucosma heringiana** Jäckh
(*rubescana* auct. *nec* Constant)
Huggins's Bell

1426 **Eucosma conterminana** H.-S.
Fawn Lettuce Bell

1427 **Eucosma tripoliana** Barr.
(*aemulana* auct.)
Saltmarsh Bell

1428 **Eucosma latiorana** H.-S.
(*aemulana* Schläg.)
Obscure Sealed Bell

1429 **Eucosma maritima** Westw.
(*candidulana* Nolck.)
Wimmer's Bell

1430 **Eucosma campoliliana** Schiff.
(*nigromaculana* Haw.)
Beautiful Marbled Bell

1431 **Eucosma pauperana** Dup.
Scarce Rose Bell

1432 **Eucosma pupillana** Clerck
Wormwood Bell

*1433 **Eriopsela quadrana** Hübn.
Brindled Scabious Bell

*1434 **Pseudeucosma caecimaculana** Hübn.
False Sealed Bell

*1435 **Epiblema foenella** L.
White-foot Bell

1436 **Epiblema scutulana** Schiff.
(*pflugiana* Haw.)
Larger Blotch-marked Bell

1437 **Epiblema cirsiana** Zell.
Smaller Blotch-marked Bell.

1438 **Epiblema cnicicolana** Zell.
Fleabane Bell

1439 **Epiblema littoralana** Pierce
Pierce's Bell

1440 **Epiblema farfarae** Fletch.
(*brunnichiana* Frön.)
Tawny-blotched Bell

1441 **Epiblema costipunctana** Haw.
(*trigeminana* Steph.)
Three-spotted Bell

1442 **Epiblema turbidana** Treits.
Hippo Bell

*1443 **Cacochroea grandaevana** Zell.
Ballast Bell

*1444 **Pardia cynosbatella** L.
(*tripunctana* Schiff.)
Three-dotted Rose Bell

*1445 **Notocelia uddmanniana** L.
Uddmann's Bell

1446 **Notocelia suffusana** Dup.
(*trimaculana* Haw.)
Triple-blotched Bell

1447 **Notocelia rosaecolana** Doubl.
(*cynosbana* Dup.)
Lesser Brown-cloaked Bell

1448 **Notocelia aquana** Hübn.
(*roborana* Treits.)
Greater Brown-cloaked Bell

1449 **Notocelia incarnatana** Hübn.
(*amoenana* Hübn.)
Pretty Short-cloaked Bell

1450 **Notocelia tetragonana** Steph.
Square-blotched Bell

*1451 **Gibberifera simplana** F.R.
Least Cloaked Bell

*1452 **Gypsonoma aceriana** Dup.
(*comitana* Haw.)
Poplar Cloaked Bell

1453 **Gypsonoma sociana** Haw.
(*dealbana* auct. *nec* Fröl.)
White-cloak Bell

1454 **Gypsonoma dealbana** Fröl.
(*neglectana* auct. *nec* Dup.)
Neglected Cloaked Bell

1455 **Gypsonoma oppressana** Treits.
Obscure Blotch-back Bell

1456 **Gypsonoma minutana** Hübn.
Brindled Marbled Bell

1457 **Gypsonoma nitidulana** Zell.
(*ericetana* H.-S.)
Inverness Bell

*1458 **Zeiraphera ratzeburgiana** Sax.
(*tenerana* Dup.)
Ratzeburg's Bell

1459 **Zeiraphera rufimitrana** H.-S.
Cantab Bell

1460 **Zeiraphera insertana** F.
(*corticana* Hübn.)
Cock's-head Bell

1461 **Zeiraphera diniana** Guen.
(*griseana* Fletch. *nec* Hübn.)
Dingy Larch Bell

*1462 **Griselda stagnana** Schiff.
(*fractifasciana* Haw.)
Broken-barred Bell

1463 **Griselda myrtillana** Westw.
(*vacciniana* Zell.)
Whortleberry Bell

*1464 **Crocidosema plebejana** Zell.
Southern Bell

*1465 **Acroclita subsequana** H.-S.
(*hawkerana* Staint.)
Coast Spurge Bell

*1466 **Rhopobota ustomaculana** Curt.
Rannoch Bell

1467 **Rhopobota naevana** Hübn.
(*unipunctana* Haw.)
Marbled Single-dot Bell

1468 **Rhopobota geminana** Steph.
Twin-spot Bell

*1469 **Epinotia stroemiana** F.
(*bimaculana* Don.)
Stroem's Bell

1470 **Epinotia maculana** F.
(*ophthalmicana* Hübn.)
Black Double-blotched Bell

1471 **Epinotia sordidana** Hübn.
(*stabilana* Wilk.)
Clouded Alder Bell

1472 **Epinotia caprana** F.
(*piceana* Haw.)
Shining Pitch Bell

1473 **Epinotia brunnichana** L.
(*sinuana* Schiff.)
Dark-waved Bell

1474 **Epinotia solandriana** L.
Solander's Bell

1475 **Epinotia trimaculana** Don.
Mitterbach's Bell

1476 **Epinotia subocellana** Don.
(*campoliliana* Treits. *nec* Schiff.)
Retuse Marbled Bell

1477 **Epinotia bilunana** Haw.
Hoary Double-crescent Bell

1478 **Epinotia demarniana** F.R.
Spotted Cloaked Bell

1479 **Epinotia immundana** F.R.
Angle-barred Bell

1480 **Epinotia tetraquetrana** Haw.
(*angulana* Haw.)
Square-barred Bell

1481 **Epinotia nisella** Clerck
Poplar Grey Bell

1482 **Epinotia cinereana** Haw.
Mottled Ashy Bell

1483 **Epinotia tenerana** Schiff.
(*penkleriana* F.R. *nec* Schiff.)
Variable Red Bell

1484 **Epinotia nigricana** H.-S.
Wood's Bell

1485 **Epinotia nemorivaga** Tengst.
(*finitimana* Doubl.)
Bright Silver-barred Bell

1486 **Epinotia tedella** Clerck
(*hyrciniana* Wilk.)
Streaked Pine Bell

1487 **Epinotia fraternana** Haw.
(*proximana* H.-S.)
Cinereous Silver-barred Bell

1488 **Epinotia paykulliana** F.
(*ramella* H.-S. *nec* L.)
Grey Double-crescent Bell

1489 **Epinotia signatana** Dougl.
Black-blotched Bell

1490 **Epinotia nanana** Treits.
Dwarf Pine Bell

1491 **Epinotia rubiginosana** H.-S.
(*bouchardana* Doubl.)
Scots-fir Bell

1492 **Epinotia cruciana** L.
Red Cross Bell

1493 **Epinotia augustana** Hübn.
Narrow Silvery Bell

1494 **Epinotia mercuriana** Fröl.
(*monticolana* Dup.)
Common Silver-striped Bell

1495 **Epinotia crenana** Hübn.
Notched Single-dot Bell

1496 **Epinotia pygmaeana** Hübn.
Dingy Spruce Bell

1497 **Epinotia subsequana** Haw.
(*pygmaeana* Wilk. *nec* Hübn.)
Faint Silver-striped Bell

ANCYLINAE

*1498 **Ancylis achatana** Schiff.
Marbled Tooth Roller

1499 **Ancylis comptana** Fröl.
Delicate Strawberry Roller

1500 **Ancylis unguicella** L.
Broken-barred Roller

1501 **Ancylis uncana** Hübn.
(*uncella* Hein.)
Bridge Roller

1502 **Ancylis geminana** Don.
(*biarcuana* Steph.)
Double-arched Roller

1503 **Ancylis inornatana** H.-S.
(*subarcuana* Dougl.)
Sharp-angled Roller

1504 **Ancylis diminutana** Haw.
Festooned Roller

1505 **Ancylis mitterbacheriana** Schiff.
Mitterbach's Red Roller

1506 **Ancylis upupana** Treits.
Dark Roller

1507 **Ancylis obtusana** Haw.
Blunt Blotched Roller

1508 **Ancylis laetana** F.
(*harpana* Hübn.)
Hooked Marbled Roller

1509 **Ancylis tineana** Hübn.
Rannoch Roller

1510 **Ancylis unculana** Haw.
(*derasana* Hübn.)
Hooked Blotched Roller

1511 **Ancylis badiana** Schiff.
(*lundana* F.)
Lund's Roller

*1512 **Ancylis paludana** Barr.
Fen Roller

1513 **Ancylis myrtillana** Treits.
Lyell's Roller

1514 **Ancylis apicella** Schiff.
(*siculana* Hübn.)
Hook-tipped Roller

OLETHREUTINAE

*1515 **Eudemis profundana** Schiff.
Diamond-backed Marble

1516 **Eudemis porphyrana** Hübn.
(*pomedaxana* Pierce)
Cider Marble

*1517 **Bactra furfurana** Haw.
Mottled Bran Marble

1518 **Bactra lanceolana** Hübn.
Dusty Marble

1519 **Bactra robustana** Christoph
(*scirpicolana* Pierce)
Pierce's Marble

*1520 **Lobesia reliquana** Hübn.
(*permixtana* Hübn. *nec* Schiff.)
Orange-and-black Marble

1521 **Lobesia abscissana** Doubl.
(*fuligana* Haw. *nec* Hübn.)
Smoky-barred Marble

1522 **Lobesia littoralis** Curt.
(*venustana* Dougl.)
Shore Doubtful Marble

1523 **Lobesia euphorbiana** Freyer
Spurge Marble

*1524 **Endothenia gentianaeana** Hübn.
(*oblongana* Haw.)
Teazle Long-cloaked Marble

1525 **Endothenia sellana** Fröl.
Larger Dingy Marble

1526 **Endothenia pullana** Steph.
Smaller Dingy Marble

1527 **Endothenia marginana** Haw.
Bordered Narrow Marble

1528 **Endothenia carbonana** Doubl.
Dark-barred Ashy Marble

1529 **Endothenia ustulana** Haw.
(*fuligana* auct. *nec* Hübn.)
Scorched Blunt Marble

1530 **Endothenia nigricostana** Haw.
Black-edged Marble

1531 **Endothenia ericetana** Westw.
Heath Marble

1532 **Endothenia antiquana** Hübn.
(*quadrimaculana* Haw.)
Blotched Marble

a good genus!

*1533 **Apotomis semifasciana** Haw.
Short-barred Grey Marble

1534 **Apotomis lineana** Schiff.
(*hartmanniana* L.)
Short-barred White Marble

1535 **Apotomis turbidana** Hübn.
(*picana* Fröl.)
Greater Cloaked Marble

1536 **Apotomis betuletana** Haw.
Birch Marble

1537 **Apotomis capreana** Hübn.
Sallow Marble

1538 **Apotomis sororculana** Zett.
(*praelongana* Guen.)
Narrow-winged Marble

1539 **Apotomis sauciana** Fröl.
Dark Long-cloaked Marble

1540 **Apotomis grevillana** Curt.
(*staintoniana* Barr.)
Greville's Marble

1541 **Apotomis pruniana** Hübn.
Lesser Cloaked Marble

*1542 **Sciaphila branderiana** L.
Brander's Great Marble

*1543 **Orthotaenia undulana** Schiff.
(*urticana* Hübn.)
Barred Nettle Marble

*1544 **Hedya variegana** Hübn.
(*nubiferana* Haw.)
Cloudy White Marble

1545 **Hedya ochroleucana** Fröl.
Common Long-cloaked Marble

1546 **Hedya atropunctana** Zett.
(*dimidiana* Sodof.)
Dotted Cloaked Marble

1547 **Hedya salicella** L.
White-backed Marble

*1548 **Olethreutes arcuella** L.
Arched Marble

1549 **Olethreutes obsoletana** Zett.
(*irriguana* H.-S.)
Cooke's Mountain Marble

1550 **Olethreutes doubledayana** Barr.
Fen Marble

1551 **Olethreutes decrepitana** H.-S.
(*bifasciana* Haw.)
Double-barred Orange Marble

1552 **Olethreutes penthinana** Guen.
(*postremana* Zell.)
Northern Balsam Marble

1553 **Olethreutes mygindana** Schiff.
(*fulvipunctana* Haw.)
Tawny-dotted Marble

1554 **Olethreutes arbutella** L.
Mountain Bearberry Marble

1555 **Olethreutes metallicana** Hübn.
(*alternana* Wilk.)
Alternate-barred Marble

1556 **Olethreutes schulziana** F.
Bentley's Marble

1557 **Olethreutes palustrana** Zell.
Northern Silver-striped Marble

1558 **Olethreutes olivana** Treits.
(*micana* auct.)
Silvered Marble

1559 **Olethreutes lacunana** Schiff.
(*herbana* Guen.)
Indefinite Marble

1560 **Olethreutes rivulana** Scop.
(*conchana* Hübn.)
Common Silver-striped Marble

1561 **Olethreutes leucotreta** Meyr.
Peach Marble

*1562 **Exartema aurofasciana** Haw.
(*latifasciana* Meyr. *nec* Haw.)
Broad-barred Marble

*1563 **Celyphoides cespitana** Hübn.
Meadow Barred Marble

*1564 **Celypha woodiana** Barr.
Mistletoe Marble

1565 **Celypha striana** Schiff.
Straight-barred Marble

1566 **Celypha purpurana** Haw.
Purplish Marble

1567 **Celypha rufana** Scop.
Lakes Marble

(*To be continued.*)

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